ISSN 2411-5096

JSMDC

Journal of Sharif Medical & Dental College

SHARIF
Medical & Dental College

01/ Vol.8
June
2022

JSMDC

Journal of Sharif Medical & Dental College

Volume 8 | Number 01 | June 2022

JSMDC is recognized by:

- Higher Education Commission (HEC), Pakistan
- Pakistan Medical & Dental Council (PMDC)

JSMDC is indexed in:

- PakMediNet
- Index Medicus for the Eastern Mediterranean Region (IMEMR)

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Printed by
ALIGARH Publisher
Ghalib Market, Gulberg III,
Lahore 54660
Ph:042-35771801-5
www.aligarh.com.pk

Annual Subscription Fee:
PKR.1500/-

Editorial

Reflective Practices: Importance for Medical Students

Uzma Shahid

"Reflection is the instrument by which experiences are translated into dynamic knowledge"[1]

Reflective writing is considered as a component of modern healthcare practices. It is a vital part of continuing professional development and is currently encouraged by educational institutions and healthcare professionals.[2] Reflective practices mean to mentally wander through where we have been and to try to make some sense out of it. The ability to become reflective in practice has become a necessary skill for health professionals.[3]

Reflection is considered as one of the most useful learning experiences. It is a process of "learning to learn," it must be taught for better future professionals, and cannot be left to develop on its own**.** Written reflections are helpful for learners to integrate new learning into their skills and knowledge.[4] Being reflective can help learners to integrate the effective perspective of learning explicitly and create a favorable environment for clinical learning. In such type of conducive environment, numerous aspects of professional roles could be learned and experienced. Eventually, it may lead to better and more comprehensive decision-making of ill-defined and complicated problems.[5]

Most commonly, reflections can be on thoughts, experiences, and emotions. Reflection is widely assumed to include one's relationship to both the inner and outer worlds. It's all about surprise, doubt, and thinking outside the box. Emotions play an important role.[6]

The learner may become aware of their experiences while practicing reflection to gain a deeper understanding. Reflective writings are recommended as an effective method for developing critical thinking and learning.[7] It helps in the development of self-expression and broadening one's vision as it breaks the whole experience into smaller and understandable chunks. Thereby, adding depth and breadth to the learning for the achievement of personal development goals.[1]

Improvement of traditional medical teaching including the latest assessment strategies & reflection practices would result in a better outcome. This approach may eventually bring up future professionals, who are more capable to meet the challenges in daily patient care. Health professionals commonly encounter diverse patient scenarios in clinics, that can be very simple or complicated and the attribute of being reflective may lead to critical thinking, which leads to an appropriate clinical judgment. Developing the ability to reflect has been documented as a vital component of the training of professional development. In-depth analysis for relective writing links students' experience-based learning and exploration of their professional identities.[8]

The emotions related to an experience are the stimulus for the new learning to occur. Reflective writing is fostering the student's aptitude for being observant and empowers them to think about the facts relevant to daily practice. As a result, students will be able to shape and update their knowledge regularly, and reflective writing can be used as a strategy for evaluating learning and identifying challenges associated with experiences that may ultimately harness their learning experience.[9]

Being professionally competent means one should hold many attributes; e.g., the use of appropriate knowledge, skills, attitudes, values, communication skills, self-reflection, and clinical reasoning.[1] The reflective professionals are ones, who are capable of being thoughtful and considering their acts carefully, to make an appropriate clinical judgment. Health professional graduates must be competent in their procedural skills and also capable of being reflective, which helps to develop critical thinking to make appropriate clinical decisions.[10]

Overcoming hesitation to express their thoughts regarding clinical experiences and putting those in reflection writing is difficult for some students. Another hurdle for the students is language difficulties, which restrict them to express their thoughts in words precisely.[6] So, self-reflection can help students in many ways and have a significant impact on their learning.[11]

It is documented that guiding students' reflective writing in the work-based situation using a reflective

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Received: April 11, 2022; Accepted: June 3, 2022

model can be helpful to be proactive towards their learning and development of clinical skills. It will eventually transform learning and build a framework for new experiences. Teaching reflective journal writing could help students to identify their learning needs, as it supports learning from experience.[12] A facilitator can bring an interest in students to assess and analyze their actions systematically as well as critically and formulate alternative actions at the workplace. Reflective writing has a crucial role in fostering reasoning and analysis skills. Furthermore, the ability to reflect on one's performance is an important skill for professional & personal development.[13]

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Original Article

Comparison of Peroneus Longus Tendon Graft versus Bone-Patellar Tendon-Bone Graft in Anterior Cruciate Ligament Reconstruction

Farooq Azam Khan, Bilal Ahmad Abbas, Talha Qureshi, Abbas Bajwa

ABSTRACT

Objective: To determine the effectiveness of peroneus longus tendon (PLT) graft versus bone-patellar tendon-bone (BPTB) graft in anterior cruciate ligament (ACL) reconstruction.

Methodology: It was a quasi-experimental study conducted in the Orthopedics Department of the Sharif Medical City Hospital, Lahore. After obtaining ethical approval, 30 patients were included in the study by a non-probability convenient sampling technique. Written informed consent was taken from all the patients. The patients were divided into two groups. Patients in group A were treated with an arthroscopic assisted bone-patellar tendon-bone graft and group B with an arthroscopic assisted peroneus longus tendon graft. Functional treatment outcomes were determined by the Cincinnati Knee Rating System (CKRS) and International Knee Documentation Committee (IKDC) scores, preoperatively, and 6 months after surgery. The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.

Results: The operative time was less in group B (45±10 min) as compared to group A (75±15 min). Average graft thickness in both groups was almost similar with a relatively larger graft harvest in group B patients (8.4±1.3 mm). There was no significant difference in CKRS and IKDC scores between the two groups, preoperatively, and after 6 months.

Conclusion: Peroneus longus tendon is the first-line, safe, and effective graft for anterior cruciate ligament reconstruction. The functional outcome of the peroneus longus tendon graft is comparable to that of the bone-patellar tendon-bone graft.

Keywords: *Knee injury. Patellar tendon. Anterior cruciate ligament reconstruction.*

INTRODUCTION

Anterior cruciate ligament (ACL) injury is the most common knee injury. The incidence of ACL rupture ranges from 30 to 78 per 100,000 person annually.[1] The ligament has no blood supply so it cannot heal itself. This leads to a significant physical and economic burden for patients and affects their quality of life. The anterior cruciate ligament prevents anterior displacement. It consists of two bundles twisted around in a spiral fashion and is attached from the anterior part of the tibial spine to the medial part of the lateral femoral condyle. It is usually injured by a rotating force.[2] Contact sports like football and squash are the most common sports involved in the injury of ACL. It can also be damaged by trauma especially road traffic accidents (RTA) involving twisting injury around the knee.[1]

Anterior cruciate ligament tear frequently occurs in young adults with the age ranging from 16 to 39 years. Male patients are more frequently affected.[3] Patients usually present with pain and swelling in the acute phase. Later on, they develop instability and locking of the knee.[4] The torn ACL can be clinically diagnosed with certain knee examination techniques like Lachman and anterior drawer tests. However, the diagnosis is confirmed by the use of magnetic resonance imaging (MRI).[3]

Surgical treatment is essential to maintain the blood supply. Surgery can be performed by open and arthroscopic methods. The most common method of ACL reconstruction is the utilization of a bone-patellar tendon-bone graft. It contains the distal portion of the patella, the central half of the patellar ligament, and the middle portion of the tibial tuberosity.[5] This graft is usually considered the gold standard and the reconstructed graft has a strength of approximately 600 Newton. The graft, however, affects postoperative rehabilitation and can also result in weakness of the quadriceps.[6] Other available options are quadrupled hamstring tendon graft using semimembranosus and gracilis tendons. This graft has the advantage of sparing the quadriceps but weakens the hamstring. The strength of the graft is also inferior compared to the bone-patellar tendon-bone graft.[6] Peroneus longus tendon graft is taken from the lateral compartment of the leg and both the major muscle groups around the knee are spared. The eversion of the foot is not affected as there is the synergistic action of evertors with peroneus brevis. The sparing of quadriceps and hamstring results in earlier rehabilitation and earlier return to sports.[7]

Anterior cruciate ligament injury is frequently encountered in Orthopedics and its successful treatment is a great challenge for clinicians. Despite the availability of surgical treatment, the chronic pain and instability of the knee is a major cause of morbidity and affect the quality of life of the patients.[4] Autografts can be taken from different muscles but still, there is a lack of consensus regarding the best graft for ACL reconstruction. This study was planned to determine

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Received: March 28, 2022; Accepted: May 10, 2022

the results of the peroneus longus tendon graft and compare it with the traditional bone-patellar tendon-bone graft in ACL reconstruction. It will help us to utilize peroneus longus tendon graft in the future for the reconstruction of ACL.

METHODOLOGY

It was a quasi-experimental study conducted in the Orthopedics Department of the Sharif Medical City Hospital, Lahore, after approval by the institutional ethical committee (Letter No: SMDC/SMRC/191-21, 08-06-2021). After obtaining ethical approval, 30 patients were included in the study by a non-probability convenient sampling technique. The patients with ACL injury for greater than 6 weeks were included in the study. The patients with a history of ankle trauma, recent steroid injection within 6 months, severe anemia, thrombocytopenia, and bleeding disorder were excluded from the study. The patients were divided into two groups with 15 patients in each group. Group A patients were treated with an arthroscopic assisted bone-patellar tendon-bone graft and group B with an arthroscopic assisted peroneus longus tendon graft. Spinal anesthesia was given to all the patients. Using the aseptic technique, under spinal anesthesia, the patients in group A were operated on by bone-patellar ligament graft. The surgery was done by arthroscope and the graft was secured by standard non-absorbable polyetheretherketone (PEEK) screws. Group B patients were operated on by harvesting the graft from a mini-incision above the lateral malleolus. Peroneus longus tendon graft was harvested by using a tendon stripper and the stump was tied with peroneus brevis using poly braided sutures. The graft was prepared by using a tensiometer and secured with the help of non-absorbable (PEEK) screws. All the patients were operated on by the same orthopaedic surgeon. After the treatment, all the operated patients went through a 6 to 8 weeks rehabilitation program. Two scores, Cincinnati Knee Rating System (CKRS) and International Knee Documentation Committee (IKDC) were obtained preoperatively, and after 6 months to assess the functional outcome.

STATISTICAL ANALYSIS

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Mean and standard deviation for quantitative variables such as age and CKRS score were calculated. The qualitative variables such as gender were represented by frequency and percentage. An independent t-test was applied to compare preoperative and postoperative CKRS and IKDC scores. The p-value ≤ 0.05 was taken as significant.

RESULTS

The present study included a total of 30 patients including 23(77%) males and 7(23%) females. The age range of the study participants was 23-34 years. The majority of the patients (57%) had a history of road traffic accident (RTA). Ten (33%) patients presented with ACL injury due to contact sports. Football (65%) and cricket (35%) were the major sports in these patients. Three (10%) patients presented with fall from ramps or stairs (Table 1).

The operative time in group B patients was less as compared to group A. Average graft thickness in both groups was almost similar and no significant difference was found when graft thickness in both groups was compared. There was no significant difference in CKRS and IKDC scores between the two groups preoperatively, and after 6 months (p-value=0.5630) (Table 2).

Table 1: Demographic Data of Study Groups

Demographic Variables		Group A	Group B
Age (Years)	**Mean±SD**	31±5	32±6
Gender Frequency & Percentage	**Male**	12(40%)	11(37%)
	Female	3(10%)	4(13%)
Mode of Injury Frequency & Percentage	**RTA**	9(30%)	8(27%)
	Sports Injuries	4(13%)	6(20%)
	Fall	2(7%)	1(3%)

Table 2: Preoperative and Postoperative Functional Assessment of Study Groups

Study Variables	Group A	Group B	p-value
Preoperative			
CKRS	65.54±9.2	66.76±7.2	0.6890
IKDC	70±9.2	72.23±6.5	0.4497
Postoperative after 6 Months			
CKRS	89.67±7.04	93±5.7	0.1656
IKDC	88.7±6.1	89.43±4.6	0.7141
Mean Operative Time (min)	75±15	45±10	0.0001*
Mean Thickness of Graft (mm)	8.1±1.5	8.4±1.3	0.5630

**Significant p-value*

DISCUSSION

Anterior cruciate ligament reconstruction is a very commonly performed surgery in Orthopedics. The surgery aims to restore the injured ACL as it does not heal itself.[8] The choice of graft is the prime consideration in reconstruction surgery. An appropriate graft with careful tunnel placement provides adequate knee stability and helps to prevent reinjury.[9] The most common grafts used for ACL reconstruction are bone-patellar tendon-bone, hamstring tendon, and peroneus longus tendon grafts. However, the harvesting of grafts is difficult and the risk of postoperative complications is high.[10] Anterior knee pain and stiffness in the postoperative period are the most common postoperative complications.[11]

In our study, 77% of patients were males and 23% were females, having an age range of 23-34 years. Another study reported that the age range of the patients with ACL injury was 18 to 36 years with 75% males and 25% females.[12] Our study reported that road traffic accident was the most common cause of ACL injury (57%), followed by sports (33%) and fall (10%). Similar results were reported in another study with RTAs as the most common cause of ACL injury (39.58%), followed by sports (35.41%), assault (14.5%), and domestic accidents (10.41%).[12]

In this study, we compared BPTB with PLT graft to repair the ACL injury. We found that the mean operative time was shorter when using PLT graft as compared with BPTB graft because the harvesting time of the PLT graft was less. Also, our study showed that the diameter of the PLT graft was 8.4 mm and BPTB was 8.1 mm. A study conducted by Joshi et al. showed similar results with less harvesting graft time (7.4 min) for PLT graft and the diameter of PLT graft was 7.9 mm with a range of 7 to 9 mm.[12] In another study, the diameter of the PLT graft was found to be 8.5 mm.[7] A study by Rhatomy et al. indicated that the thickness of peroneus longus tendon and hamstring grafts were 8.8 mm and 8.2 mm, respectively with a significant difference of 0.6.[2] Comparable results were found in the present study which indicated that the PLT graft is a better treatment option.

A study by Kumar et al. indicated that the peroneus longus graft is an appropriate autograft because it is easier to harvest. Also, it is of adequate size as well as cosmetically appealing and gives excellent postoperative knee scores.[13]

Another study showed that ACL reconstruction with PLT graft had a good IKDC score after 2 years of follow-up. So, it is a safe and effective option for reconstruction surgery of ACL injury.[12] Rhatomy et al. compared peroneus longus autograft to hamstring autograft in ACL reconstruction. The results showed no significant difference in IKDC and CKRS scores between the two groups preoperatively and at one year follow-up. However, PLT graft was associated with greater graft diameter, less hypertrophy of the thigh, and better ankle function.[2]

In another study, the patients with ACL injury underwent reconstruction with PLT and hamstring grafts. The IKDC and CKRS scores were not significantly different between the two groups. But as hamstring graft is associated with significant risks, PLT graft is a better option for ACL reconstruction.[6] Saeed et al. reported that there was no significant difference in IKDC and the American Orthopedic Foot and Ankle Society (AOFAS) scores in the PLT and HT groups.[14]

A study conducted by Bi et al. determined the effectiveness of the single-bundle anterior half of PLT in ACL reconstruction. At the 2 year follow-up, the IKDC score improved from 52.0±8.27 to 94.2±2.61. The muscle strength of the patients in ankle eversion and plantar flexion was of grade 5 with the best functional scores and no complications.[15]

CONCLUSION

The peroneus longus tendon is the first-line, safe, and effective graft for anterior cruciate ligament reconstruction. The functional outcome of the peroneus longus tendon graft is comparable to that of the bone-patellar tendon-bone graft. But as compared to BPTB graft, PLT graft is associated with increased tensile strength, less operative time, increased diameter of graft, and no postoperative complications.

LIMITATIONS & RECOMMENDATIONS

Despite the PLT graft as the best treatment option for ACL injury, the choice of graft depends on various factors such as associated injuries, patient activities, co-morbidities, and postoperative rehabilitation plan. The association of these factors with PLT graft was not considered in our study. The follow-up period in our study was 6 months. Further studies with a minimum of 1 year follow-up are recommended.

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Original Article

Histological Effects of Glutamine on Gentamicin-Induced Nephrotoxicity in Wistar Rats

Ayesha Khalid, Saira Aslam, Ammara Ghafoor, Sania Asif

ABSTRACT

Objective: To determine the protective effects of glutamine on gentamicin-induced nephrotoxicity.

Methodology: This was a randomized control study which was conducted at the University of Health Sciences, Lahore. Total 36 rats, aged 6-8 weeks with body weights between 170-200 g were divided into four equal groups A to D by random balloting method. Group A was the control group and was given distilled water only by oral gavage for six days. Group B was given gentamicin for six days intraperitoneally. Group C was given a single dose of glutamine by oral gavage and were sacrificed after 24 hours. Group D was given both glutamine and gentamicin intraperitoneally for six days. The animals of groups A, B & D were sacrificed at the end of the experiment on the 7th day and then kidneys were excised from rats and processed for histological examination.

Results: Histological parameters of groups A, C, and D showed that proximal convoluted tubules (PCT) and distal convoluted tubules (DCT) of the kidney appeared normal. There were no signs of necrosis in epithelial lining, broken basement membrane as well as disrupted brush borders. In group B, gentamicin administration resulted in the deformation of glomeruli with thickened basement membrane and widening of urinary space. Also, degenerative changes were seen in PCT in the gentamicin group.

Conclusion: The nephrotoxicity and the oxidative damage caused by gentamicin on the kidneys of rats were incredibly significant. The use of glutamine supplements had shown promising results in providing protective effects on kidneys in the presence of gentamicin in rats.

Keywords: *Glutamine. Gentamicin. Rats.*

INTRODUCTION

Kidney function is crucial for the maintenance of homeostasis in the human body. Being a vital organ, it has an important role in detoxification and regulation of the acid-base balance. In addition, kidneys also play role in the synthesis and regulation of erythropoietin essential for blood pressure regulation.[1]

Gentamicin is an effective aminoglycoside antibiotic used for the treatment of a variety of bacterial infections. Its long-term use in clinical practice is limited due to renal damage and oxidative stress. The onset of renal toxicity is usually at a lower rate that is evident by a slow rise in daily serum creatinine levels as compared to the renal failure caused by other agents. Renal function markers usually increase after 7 to 10 days of the start of treatment with aminoglycosides and in more than half of the patients renal damage occurs after the completion of the dose.[2]

Nephrotoxic changes induced by gentamicin in the proximal convoluted tubules (PCT) result from its lysosomal internalization which eventually causes cell necrosis and tubular obstruction by the release of hydrolase enzymes.[3] Gentamicin affects the kidneys as it is retained in the epithelial linings of proximal convoluted tubules of the kidneys after glomerular filtration. This accumulation of gentamicin in the epithelial cells damages the kidneys and hinders their normal functioning, which include the removal of wastes from the blood, regulating the balance of electrolytes in the body, and maintaining the levels of fluids in the body. In the kidneys, like other aminoglycosides, gentamicin also produces reactive oxygen species (ROS) such as hydrogen peroxide (H_2O_2) and hydroxyl radical of renal cortical mitochondria which directly attack and damage the linings of the kidneys and cause an increase in lipid peroxidation.[4]

A variety of antioxidants have been used to minimize the oxidative damage caused by gentamicin and provide a protective effect on the kidneys. Glutamine, a non-essential amino acid, is considered a promising antioxidant and a useful compound to cope with the nephrotoxic effects of gentamicin. Glutamine acts as an immuno-nutrient as it preserves the immune competence of the body by promoting wound healing after major surgical procedures.[5] Glutamine repairs the intestinal mucosal injury in ischemia-reperfusion by reducing the expression of high mobility group box 1 (HMGB1) and inflammatory cytokines and reducing the permeability of the intestinal mucosa.[6] A study on rats has shown that glutamine promotes antioxidant protection and reduces inflammation.[7]

The role of glutamine as a potential antioxidant and a useful ameliorating agent in minimizing gentamicin-induced nephrotoxicity has also been investigated. The administration of glutamine injections to rats who have undergone tubular necrosis, formation of renal casts, and exfoliation of tubular epithelial cells due to

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Received: April 15, 2022; Accepted: May 29, 2022

ischemic shock, leads to the expression of heat shock protein which relieves the symptoms of kidney damage.[8]

This study was designed to observe the gentamicin-induced nephrotoxic changes in proximal convoluted tubules and the effect of glutamine against gentamicin-induced nephrotoxicity in Wistar rats.

METHODOLOGY

A randomized control study was conducted at the University of Health Sciences, Lahore after the approval by the University ethical committee (Letter No: UHS/Education/110-19/3465, 20-12-2019) on 36 healthy, adult male Wistar rats of the age of 6-8 weeks. The study was conducted from January to March 2020. The animals were divided randomly, using the balloting method into four equal groups: A, B, C, and D containing 9 animals each. Rats were kept under standard conditions (temperature of 23±2 ºC, humidity of 55±5%) and were fed on a commercial standard rat diet. All procedures were carried out in a clean and aseptic environment approved by the ethical committee of the University. The weight of all the rats was recorded at the beginning and at the end of the experimental period. They were allowed to acclimatize 3-4 days before starting the experiment.

Group A was the control group and was given distilled water orally for 6 days only. Group B was given intraperitoneally 100 mg/kg body weight of gentamicin for six days. Group C was given a single dose of glutamine (300 mg/kg body weight) by oral gavage and was sacrificed after 24 hours. Group D was given a single dose of glutamine (300 mg/kg dissolved in 1 ml of distilled water) as pretreatment on day 0 by oral gavage. After 24 hours, 100 mg/kg of gentamicin was given intraperitoneally, dissolved in 0.75 ml isotonic solution for 6 days. The animals of groups A, B & D were sacrificed on the 7th day of the experiment. The kidneys were excised from rats and processed for histological examination. For histological examination small pieces of the tissues, 3-5 mm cube, were excised and processed. The hematoxylin and eosin (H & E) and periodic acid-Schiff (PAS) staining techniques were used to analyze the kidney tissues for the presence of nephrotic damage in the four groups.

STATISTICAL ANALYSIS

The data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 22. For qualitative variables like changes in the basement membrane, epithelial necrosis, and intraluminal protein casts, frequencies and percentages were calculated. Chi-square test was applied to find the association between groups and histological parameters.

RESULTS

The hematoxylin and eosin stained sections of groups A (Figure 1a, 2a), C (Figure 1b, 2b), and D (Figure 1c, 2c) showed that proximal convoluted tubules (PCT) and distal convoluted tubules (DCT) of kidneys were normal. There were no signs of necrosis in epithelial lining (0% in group A and C, 11% in group D) and broken basement membrane (0% in group A and C, 22% in group D) as well as disrupted brush borders (0% in group A and C, 22% in group D) (Table 1). In group B, gentamicin administration resulted in the deformation of glomeruli with thickened basement membrane and widening of urinary space. Degenerative changes were seen in PCT; there was marked necrosis (89%) with partial loss of brush border (89%), vacuolation, desquamating cells, and luminal casts (33%) in PCT (Table 1, Figure 1d). At places, there were strips of necrosed tubules with complete obliteration of lumen and increased eosinophilia. The basement membrane was also disrupted in some sections of group B. Interstitium showed marked inflammation mostly perivascular infiltration of macrophages and lymphocytes. Almost all the intraglomerular and extraglomerular vessels were congested and hyalinized with thickened walls (Figure 2d).

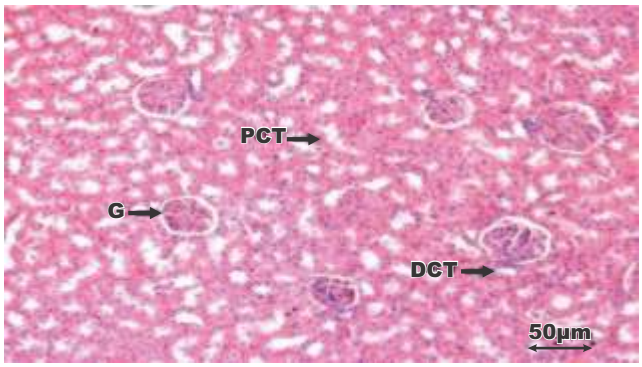

Figure 1a: Group A - Photomicrograph Showing PCT, Glomeruli (G), DCT, and Normal Interstitium (H & E stain, 100x magnification)

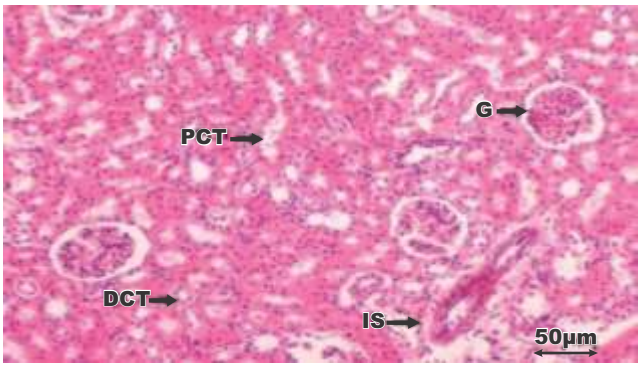

Figure 1b: Photomicrograph of Histological Section from Kidney of Group C Showing Normal Looking Glomeruli, PCT, DCT, and Normal Interstitium with a Blood Vessel (H & E stain, 100x magnification)

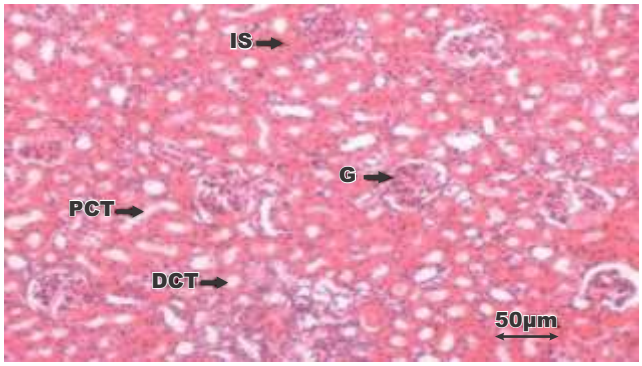

Figure 1c: Group D - Histological Section of Kidney Photomicrograph Showing Glomeruli (G), PCT, DCT, and Interstitium (IS). Slight Inflammation is Present (H & E stain, 100x magnification)

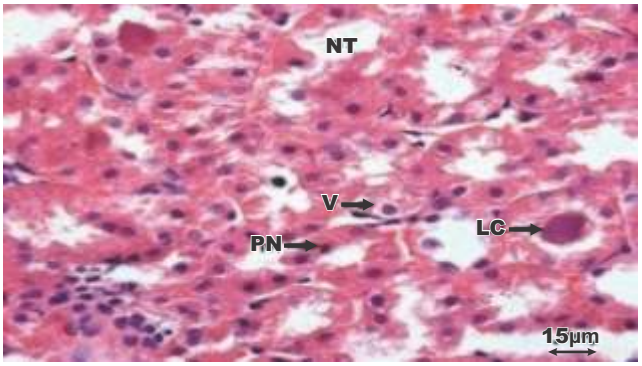

Figure 1d: Group B - Photomicrograph of Kidney's Cortex Showing Necrosed Tubules (NT) with Bigger Eosinophilia and Loss of Nuclei, Epithelial Cells with Vacuolar Degeneration (V) and Pyknotic Nuclei (PN). Tubular Lumen either Totally Obliterated or Filled with Casts (H & E stain, 100x magnification)

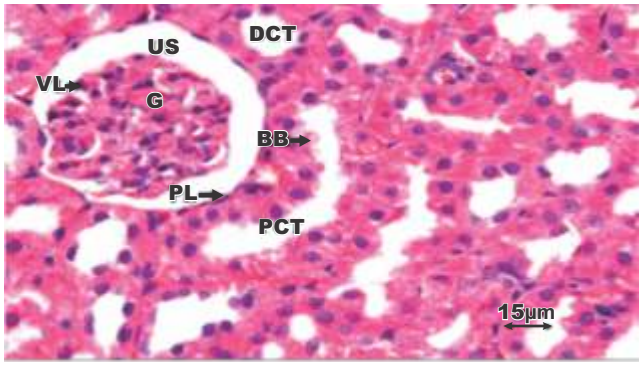

Figure 2a: Photomicrograph of the Cortical Part of Kidney of Group A Showing the Intact Brush Border (BB) of PCT, DCT, Parietal Layer (PL), Visceral Layer (VL), Urinary Space (US), and Glomerulus (G) (H & E stain, 400x magnification)

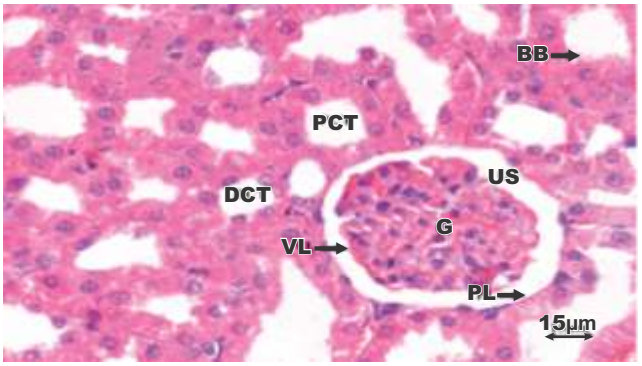

Figure 2b: Group C - Photomicrograph of Cortex of Kidney is Showing Normal Glomerulus (G) Enclosed by Visceral Layer (VL) & Parietal Layer (PL) of Bowman's Capsule having Urinary Space (US) in between. PCT with Prominent Brush Border (BB) (H & E stain, 400x magnification)

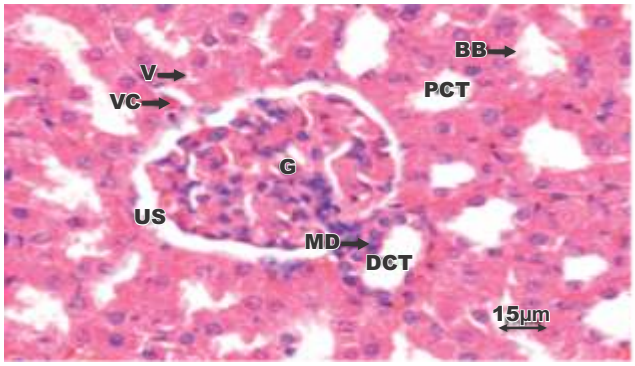

Figure 2c: Group D - Photomicrograph of Cortex of Kidney from Prophylactic Group Showing Glomerulus (G) Enclosed by Visceral and Parietal Layer of Bowman's Capsule having Urinary Space (US) in between. PCT Lined with Cuboidal Epithelium having Distinct Brush Border (BB), Vacuolations (V) Present in a Few Cells. DCT with Simple Cuboidal Epithelium Forming Macula Densa (MD) Near Vascular Pole of Renal Corpuscle. Slight Vascular Congestion (VC) is also Observable (H & E stain, 400x magnification)

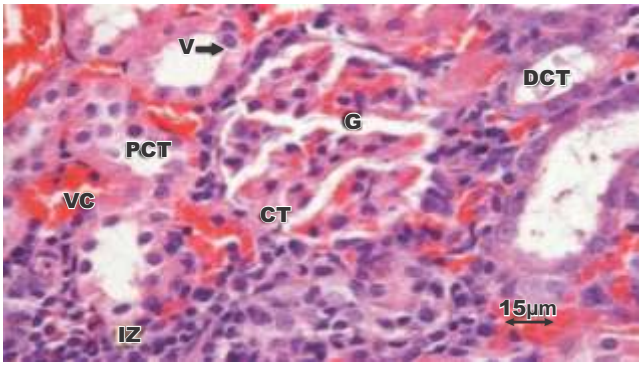

Figure 2d: Group B - Photomicrograph of Kidney's Cortex Showing Glomerulus (G), with Capillary Wall Thickening (CT) and Adhesions between Capillary Tuft and Bowman's Capsule. PCT Lined with Cuboidal Cells with Disrupted Cell Boundaries having Vacuolation (V) are Shown. DCT with Simple Cuboidal Epithelium. Interstitium Showing Inflammatory Zone (IZ) and Vascular Congestion (VC) (H & E stain, 400x magnification)

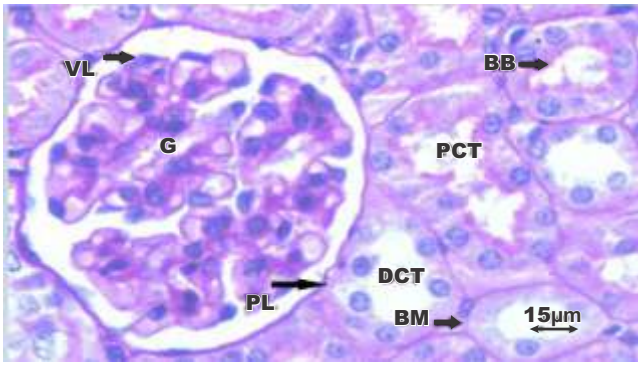

Figure 3a: Group A - Kidney Cortical Part is Shown in Photomicrograph. PCT are Intact with Brush Border (BB) Basement Membrane (BM) is Showing Normal Looking Parietal Layer (PL), Visceral Layer (VL), Urinary Space (US) and Glomerulus (G) (PAS stain, 400x magnification)

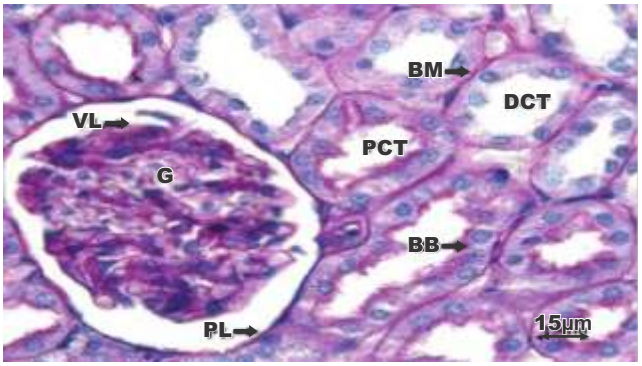

Figure 3b: Group C Shows a Photomicrograph of the Kidney's Cortex. We Observed Normal Glomerulus(G) Enclosed by Visceral (VL) and Parietal Layer (PL) of Bowman's Capsule having Urinary Space (US) between PCT with Prominent Brush Border (BB) and Basement Membrane of all the Tubules are Intact Including Glomerulus (PAS stain, 400x magnification)

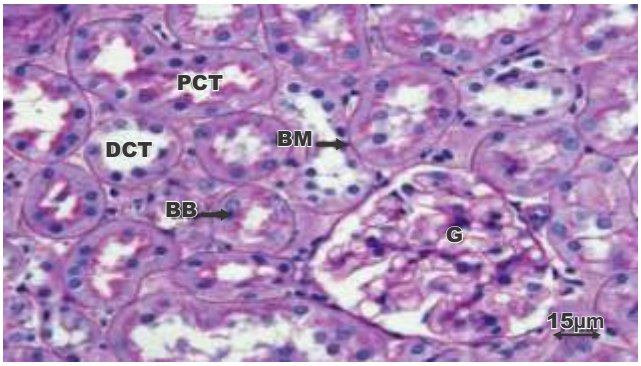

Figure 3c: Group D is Showing a Photomicrograph of the Kidney's Cortex. Normal Glomerulus (G) Enclosed by Bowman's Capsule. PCT are Lined with Simple Cuboidal Epithelium having Prominent Brush Border (BB) and Basal Membrane (BM) are Observed. The Presence of DCT with Simple Cuboidal Epithelium is Shown and Basement Membrane is Intact (PAS stain, 400x magnification)

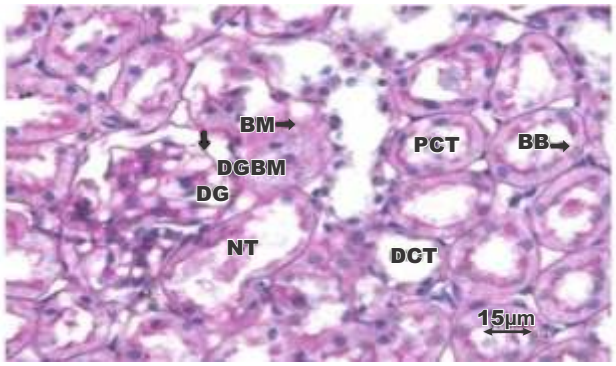

Figure 3d: Photomicrograph of Cortex of Kidney from Gentamicin Treated Group B. Deformed Glomerulus (DG), Disrupted Glomerular Basement Membrane (DGBM); PCT, Basal Membrane (BM) having Degenerating Cell Boundaries with Loss Of Brush Border (BB) having Vacuolation are Observed (PAS stain, 400x magnification)

The periodic acid-Schiff (PAS) stained sections of groups A (Figure 3a), C (Figure 3b), and D (Figure 3c) showed no sign of nephrotic damage. There were no pathologies seen in the kidney tissues and all the parts of the kidney were intact (Figure 3a). Analysis of PAS stained kidney tissues from group B animals showed indistinct PCT with epithelial necrosis, vacuolization, destruction of brush border membrane, presence of intraluminal protein casts, and damage to the basement membrane, and also the presence of vacuolization and inflammation as well as vascular congestion (VC) which were not observed in other three groups (Figure 3d).

Table 1: Comparison of Histopathological Parameters among Groups A, B, C, and D

Parameters	Group A		Group B		Group C		Group D		p-value
	Present	Absent	Present	Absent	Present	Absent	Present	Absent	
Disrupted Brush Border	0(0%)	9(100%)	8(89%)	1(11%)	0(0%)	9(100%)	2(22%)	7(78%)	<0.001*
Epithelial Necrosis	0(0%)	9(100%)	8(89%)	1(11%)	0(0%)	9(100%)	1(11%)	8(89%)	<0.001*
Intraluminal Protein Casts	0(0%)	9(100%)	3(33%)	6(67%)	0(0%)	9(100%)	1(11%)	8(89%)	0.08
Broken Basement Membrane	0(0%)	9(100%)	8(89%)	1(11%)	0(0%)	9(100%)	2(22%)	7(78%)	<0.001*

**Significant p-value*

DISCUSSION

Glutamine has many remarkable functions in the cell, including regulation of cellular redox balance and apoptosis.[9] Gentamicin causes apoptosis in proximal tubule epithelial cells of kidneys in rats.[10] In the present study, histological parameters of groups A, C, and D showed that proximal convoluted tubules and distal convoluted tubules of the kidney were normal. There was no sign of necrosis in the epithelial lining and the basement membrane or brush borders were prominent. In group B, the PCT showed visible necrosis and destruction. The PAS staining of kidney tissue from group B rats showed indistinct PCT with epithelial necrosis, vacuolization, disruption of brush border, presence of intraluminal protein cast, and damage to the basement membrane. Further, in group B the interstitium showed inflammatory zone (IZ) and vascular congestion (VC), which was not observed in the other three groups. Another study reported similar results of kidney damage in all gentamicin-induced groups, which was necrosis in the convoluted tubule and the Bowman's capsule as compared to the control group.[11] A review was conducted by Randjelovic et al. to focus on the current knowledge available regarding gentamicin-induced nephrotoxicity. They reported that gentamicin causes necrosis of tubular epithelial cells, especially in proximal convoluted tubules. It also reduced glomerular filtration leading to the accumulation of proteins and increase excretion of potassium & sodium.[12]

In the current study, we observed epithelial vacuolization, tubular necrosis, and glomerular atrophy in gentamicin-treated animals. Another study reported that intramuscular injection of gentamicin (100 mg/kg/day) in mice for 10 consecutive days can lead to these deleterious effects on kidney structure and function. The cells of necrotic tubules get deprived of their structural and polysaccharide proteins leading to major histological and histochemical alterations in the kidneys resulting in renal failure.[13]

The nephrotoxic effects of gentamicin are largely attributed to disturbances in mitochondrial metabolism which eventually leads to an increase in oxidative stress, which has injurious effects on the cellular function and metabolic integrity of the body. The role of reactive oxygen metabolites (ROS) in gentamicin-induced nephrotoxicity has also been recognized by various other studies.[12,13]

In our study, we observed normal PCT with distinct brush border membrane and DCT in PAS stained sections of kidney tissues in group D animals treated with glutamine. Another study reported similar results when they treated the animals with ficus carica (fig) leaf extract along with gentamicin. They reported that the histological preparations from the gentamicin-positive group showed proximal renal tubular necrosis, degeneration of epithelial cells, and loss of brush border.[13] Further, as compared to the gentamicin-treated group, there was a significant improvement in kidney function and structure in groups that received ficus carica leaf extract along with gentamicin and had nearly normal-looking renal glomeruli with patchy areas of tubular necrosis and reappearance of complete brush borders. These findings also support our results, and it can be concluded that like green tea, ficus carica, leaf extract, and kiwi fruit, glutamine also protects the kidneys from gentamicin toxicity and oxidative damage by improving antioxidant defense, energy metabolism, and tissue integrity.[14] Similarly, the protective effects of other natural compounds including black seeds of nigella sativa (black cumin) and spinach (spinacea oleracea) have also been investigated and have shown to ameliorate the nephrotoxic effects of aspirin and cyclosporin.[15] Another recent study conducted in Iran showed that exogenous glutathione (100 mg/kg intraperitoneally) reduced inflammatory renal changes and improved renal dysfunction in rats with gentamicin-induced acute kidney injury.[9]

CONCLUSION

The nephrotoxicity and renal oxidative damage caused by gentamicin are incredibly significant. Since the effectiveness of gentamicin in the control of various bacterial diseases is quite significant, it is the need of the hour to establish the role of nephroprotective agent with gentamicin administration. The use of glutamine supplements has shown promising results in providing protective effects on kidneys in the presence of gentamicin in rats.

LIMITATIONS & RECOMMENDATIONS

The study has some limitations as the sample size was small and due to inherent time constraints, the duration of the experiment was kept for 7 days. Further studies are needed to standardize the dose of ameliorating compounds so that a reference protocol can be developed for the protection of gentamicin-induced nephrotoxicity. Research should be carried out to explore the dose and dimensions of the use of glutamine and other amino acids as supplements to reduce the negative effects of the drugs that cause oxidative damage and toxicity.

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Original Article

Correlation of Clinical Severity of COVID-19 Infection with Computed Tomography Severity Score in Patients Presenting to a Tertiary Care Hospital of Lahore

Munaza Javed, Muhammad Atif Qureshi, Muhammad Naeem Akhtar, Tuba Tariq, Osama Habib, Ramsha Jabbar

ABSTRACT

Objective: To correlate the clinical severity of COVID-19 infection with computed tomography severity score (CTSS) in a tertiary care hospital of Lahore.

Methodology: This retrospective descriptive observational study was conducted at Chaudhary Muhammad Akram Teaching Hospital, Lahore. One hundred and sixty six real-time polymerase chain reaction (RT-PCR) positive COVID-19 patients were enrolled in this study. Clinical COVID-19 disease severity was classified into asymptomatic, symptomatic, severe, and critical disease. A 25 point computed tomography (CT) severity score was utilized to classify the disease as mild, moderate, and severe. Statistical Package for Social Sciences (SPSS) version 20 was used for statistical analysis. The association between clinical severity of COVID-19 infections was studied with CTSS by applying Kendall's tau-b correlation coefficient.

Results: Out of the 166 patients, 91(55%) were males while 75(45%) were females. The mean age was 58.09±15 years and its range was 20 to 90 years. A statistically significant positive association (τb=0.615 and p=0.01) was observed between the clinical severity of COVID-19 infection and CTSS.

Conclusion: A positive association exists between the severity of COVID-19 infection and CT severity score.

Keywords: *COVID-19. High-resolution computed tomography. Real-time polymerase chain reaction.*

INTRODUCTION

The COVID-19 pandemic has had a great toll on the economy and health sector of the world, which has led to the collapse of health systems everywhere. Real-time polymerase chain reaction (RT-PCR) is used for the diagnosis of COVID-19 infection in suspected patients. The average time duration needed for an RT-PCR test result is 24 hours and has a false negative rate of 54%.[1,2] Lack of RT-PCR facilities, faulty sampling collection technique, delay in reports, and false negative test result rate have compounded the difficulties experienced by the health care professionals. Some patients even got a PCR positive result after discharge from the hospital. Thus diagnosis is missed in some patients because of false negative results which leads to delay in diagnosis and initiation of proper management.[3]

An Iranian study along with many other international studies has recommended to take the help of radiological investigations to aid in making the diagnosis of COVID-19 in patients with a negative PCR result but who have a high suspicion of disease.[4] Chest X-ray (CXR) is an inexpensive and readily available modality in rural and urban health facilities. It exhibits positive findings in 74% of patients with COVID-19 infection. The lung involvement in COVID-19 infection is mostly bilateral, basal with the peripheral distribution. However, CXR findings are usually seen in the later stage of the disease as compared to the early stage of COVID-19 infection.[5] Therefore, CXR is not useful in making a diagnosis or helping in the triage of COVID-19 disease in the early phase as changes are appreciated in only 9% of patients early on in COVID-19 infection while still awaiting RT-PCR results.[6]

Non-contrast high-resolution CT (HRCT) scan chest is another relatively expensive and scarcely available modality that has been utilized in making a prompt diagnosis and monitoring the course of disease in COVID-19 infection worldwide.[7] Although very resource intensive but HRCT can detect lung involvement early on in the disease even in asymptomatic patients in comparison to CXR or RT-PCR.[8] Characteristic findings of acute lung involvement by COVID-19 include peripherally distributed ground-glass opacities with predominant lower-lung involvement and crazy-paving appearance. Interstitial fibrosis is observed as a late sequela of COVID-19 infection.[9]

Moreover, HRCT can aid in the clinical assessment of physicians, which can help them in making timely decisions for the initiation of COVID-19 treatment. Secondly, various scores like COVID-19 reporting and data system (CO-RADS), total severity score (TSS), and CTSS have been developed and used to measure

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Received: April 29, 2022; Accepted: May 20, 2022

the severity of COVID-19 infection early on, while awaiting RT-PCR results. These scores have proved beneficial for early triage, management in proper high dependency unit (HDU)/intensive care unit (ICU) settings, and stratifying disease severity.[10]

Multiple international studies have reported an association of COVID-19 disease severity with HRCT severity. This study was planned to find out if any association exists between CTSS and disease severity of COVID-19 infection in our local settings as data in this regard is scarce. It could help in making timely decisions and could be used for triage and management of COVID-19 patients.

METHODOLOGY

This retrospective descriptive observational study was conducted at Chaudhary Muhammad Akram Teaching Hospital, Lahore. After taking approval from the Hospital ethical committee, 166 patients were enrolled using a convenient sampling technique (Letter No: IRB/ANMC/2021/002, 25-01-2021). The duration of the study was from March to August 2021. A confirmed case was defined as a patient with positive RT-PCR of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in nasopharyngeal swab specimens. Patients with positive RT-PCR of SARS-CoV-2 in nasopharyngeal swab specimens more than 18 years of age were included whereas COVID-19 RT-PCR negative patients less than 18 years of age were excluded from the study. Clinical disease severity of COVID-19 infection was classified as an asymptomatic, non-severe, severe, and critical disease.

Non-contrast enhanced HRCT of patients was performed at the time of admission or during the hospital stay. Each CT scan was analyzed by 2 senior radiologists having more than 5 years of experience. A 25 point CTSS score was utilized to calculate radiological severity in each patient as mild, moderate, and severe disease.[11] Case records of all the patients of the general corona ward, isolation wards, HDUs, and ICUs were studied and recorded on a preformed questionnaire.

STATISTICAL ANALYSIS

Data was entered into Statistical Package for Social Sciences (SPSS) version 20 for statistical analysis. Data contained both qualitative and quantitative variables. Qualitative variables like gender, clinical severity, and CT severity grade were described in frequency and percentage. Whereas quantitative variables like age and CTSS score were calculated as mean±SD. The association between clinical severity of COVID-19 infection was studied with CTSS by applying Kendall's tau-b correlation coefficient.

RESULTS

Out of the 166 patients, 91(55%) were males while 75(45%) were females. The mean age was 58.09±15 years and its range was 20 to 90 years. About 69.8% of patients were more than 50 years of age. One hundred and twenty five (75.3%) patients had comorbidities and 36.8%, 61.6%, and 1.6 % of them had critical, severe, and non-severe disease, respectively. The severe and critical disease was seen in 98.4% patients with comorbidities (Table 1). Common comorbidities reported were hypertension (HTN) followed by diabetes and ischemic heart disease. One hundred and twenty eight (77.1%) patients were discharged from the hospital whereas 38(22.9%) died during hospital stay out of whom thirty five (92.1%) had single or multiple comorbidities. The majority of our patients remained admitted for 1 to 2 weeks.

Multifocal involvement in the lungs was seen in 96(57.8%) patients. Ground-glass opacification was seen in every patient followed by consolidation and septal thickening. Fibrosis was seen in only 50(30.1 %) patients. Cavitations were seen in only one (0.6%) patient and two (1.2%) patients had pleural effusion.

Supplemental oxygen/artificial ventilation was required by one sixty one (97%) of our patients whereas only five (3%) patients maintained oxygen on room air.

A statistically significant positive association (tb=0.615 and p=0.01) was observed between clinical severity of COVID-19 infection and CTSS score on applying Kendall's tau-b correlation, thus pointing towards a directly proportional relationship between clinical disease severity and CTSS in patients with COVID-19 infection.

Table 1: Disease Severity and CTSS

Disease Severity	CT Severity Score			Total
	Mild	Moderate	Severe	
Asymptomatic	2(1.2%)	0(0%)	0(0%)	2(1.2%)
Non-Severe	4(2.4%)	1(0.6%)	0(0%)	5(3%)
Severe	15(9%)	71(42.8%)	22(13.3%)	108(65.1%)
Critical	0(0%)	10(6%)	41(24.7%)	51(30.7%)
Total	**21(12.6%)**	**82(49.4%)**	**63(38%)**	**166(100%)**

Table 2: Lung Involvement in HRCT

HRCT		Frequency & Percentage
Lung Involvement	**Unilateral**	9(5.4%)
	Bilateral	157(94.6%)
Total		**166(100%)**
Pattern of Lung Involvement	**Peripheral**	38(22.9%)
	Central	32(19.3%)
	Multifocal	96(57.8%)
Total		**166(100%)**

DISCUSSION

The real-time polymerase chain reaction is considered a standard test for confirming the diagnosis of COVID-19 pneumonia but unavailability, high cost, and above all non-availability of immediate results lead to undue delay in diagnosis.[12] Chest X-rays have been used in Italy to aid in diagnosis but early changes are not visible in them.[13] During this pandemic computed tomography in Egypt was used as the main diagnostic tool for early detection and management of COVID-19 pneumonia.[14] Computed tomography scans have been helpful in detecting minute changes due to COVID-19 but the cost limits its use in developing countries like Pakistan. Multiple CT severity scores comprising 25 and 40 points have been used to gauge the severity and prognosis of COVID-19 infection.[15] We used a 25 point CT scoring system which has been validated by international studies. In this study, lung involvement was mostly bilateral, multifocal with ground-glass opacification (GGO). Ground-glass opacification was seen in the majority of our patients irrespective of duration and severity of the disease. These findings are very similar to the findings of Raoufi et al. who described GGO in 84.6% of their patients. They also unveiled an association between the shape of opacities with increased mortality and reported higher mortality in patients who had linear opacities in comparison to round opacities.[16] Lung involvement was seen more in the lower zones as compared to upper zones which is consistent with other studies.[17,18]

Our patients with severe and critical disease had a CTSS score of more than 15. We found that most of the patients who required high-flow nasal oxygen (HFNO), non-invasive or invasive ventilation in our study had CTSS of more than 15. Our findings are very similar to the findings of Valk et al. They calculated CTSS in their ICU patients who needed artificial ventilation and they concluded that patients who needed artificial ventilation had higher CTSS. Furthermore, they added that higher mortality was observed in patients with higher CTSS.[19] Our findings also support these findings, as we also found high mortality in patients with higher CTSS and severe disease.[20]

We found a positive correlation between clinical disease severity and CTSS. Similar results were found in a South Asian study by Kurri et al. It was conducted on 84 patients suffering from COVID-19 infection. Their findings support our findings with minor differences as they also found a high neutrophil to lymphocyte ratio (NLR) along with a high CTSS to be associated with severe COVID-19 infection.[21]

COVID-19 not only affects the lungs early on but also has long-term consequences. Luger et al. conducted follow-up CT scans periodically over one year in their patients and reported long-term sequel. According to them, resolution of lung opacities occurred over the first six months in the majority of patients, however, they reported lung damage to be a permanent complication afterward in forty percent of their patients.[22]

CONCLUSION

There is a positive association between CTSS and disease severity of COVID-19 infection in our population**.** The score can be efficiently utilized to diagnose and isolate patients with COVID-19 infection. Moreover, it can also be helpful to triage critically ill patients and aid in the management of these patients in a dedicated area from the very start.

LIMITATIONS & RECOMMENDATIONS

In this study, RT-PCR was performed only once, and RT-PCR negative patients were excluded from the study. This is a major limitation of this study. Further studies at multiple centers could assist in deeper understanding of this association.

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Original Article

Comparison of Ondansetron versus Metoclopramide for the Management of Females Presenting with Hyperemesis Gravidarum

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ABSTRACT

Objective: To compare the outcome of ondansetron versus metoclopramide for the management of females presenting with hyperemesis gravidarum.

Methodology: It was a quasi-experimental study conducted in the Department of Gynaecology & Obstetrics, Services Hospital, Lahore. The study was completed in the period from March to August 2020. Patients diagnosed with diabetes mellitus, hypertension, multiple gestations, and allergic to medication were excluded from the study. The study comprised 60 participants who were divided into two groups. In the ondansetron group, females were given a single dose of 4 mg ondansetron diluted in 100 mL of normal saline. In the metoclopramide group, females were given a single dose of 10 mg metoclopramide diluted in 100 mL of normal saline. After 24 hours, females were asked for any episode of vomiting and nausea score. Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 22.

Results: Out of 60 females included in the study, 30 were enrolled in each group. In the ondansetron group, vomiting was found in 13(43.3%) patients in the last 24 hours after administration of the drug. In the metoclopramide group, episodes of vomiting were found in 19(63.3%) patients within 24 hours after administration of metoclopramide. The difference between the two study groups was not statistically significant (p-value=0.121). The mean nausea score was 6.70±1.09 in subjects who took ondansetron while in patients who were given metoclopramide, the score was 6.40±1.33. This difference was also not significant (p-value=0.343) in the metoclopramide group.

Conclusion: Both ondansetron and metoclopramide are equally effective for the management of females presenting with hyperemesis gravidarum.

Keywords: *Hyperemesis gravidarum. Ondansetron. Metoclopramide.*

INTRODUCTION

Hyperemesis gravidarum is a condition affecting pregnancy in 0.5-1% although it is less likely associated with mortality but has an impact on maternal morbidity. Severe symptoms of nausea and vomiting in pregnancy are termed hyperemesis gravidarum which complicates less than 1% of pregnant patients.[1] It is associated with weight loss, electrolyte imbalance, and hospital admission. These patients should be given venous thromboprophylaxis as they are potentially at risk of venous thromboembolism. It is considered as one of the major reasons for women presenting in an emergency in the first half of pregnancies. It has multifactorial etiology but the exact cause is unknown.[2] Almost 80% of all pregnant women suffer from nausea and vomiting. Genetic predisposition, hormonal changes, and infections in some cases are considered contributory factors.[3] Women suffering from severe symptoms are associated with poor maternal and fetal outcomes. These outcomes include psychological upset, financial burdens, and underlying nutritional deficiencies leading to early miscarriage and low birth weight babies.[4] The mainstay of treatment is supportive therapy but the stepwise treatment of antiemetics is considered in patients with intractable symptoms.[5] Ondansetron and metoclopramide are two drugs that have been used in practice to treat hyperemesis and their efficacy and side effect profile vary according to the response of patients.[6] Literature showed that both drugs have equal efficacy in averting nausea and vomiting in pregnant females.[7,8]

Metoclopramide is an antiemetic medication that is used to treat the symptoms. Common side effects associated with metoclopramide are extrapyramidal effects that lead to poor compliance.[9] Ondansetron, a second-line antiemetic, has potent efficacy by inhibiting the action of serotonin as a selective antagonist at the 5-hydroxytryptamine receptor. It is also used in chemotherapy-induced nausea and vomiting. Obstetricians are using ondansetron these days because of a better experience in improving symptoms and safety profile.[10]

In the local context, data pertaining to the comparison between the outcomes of ondansetron versus metoclopramide for the management of females presenting with hyperemesis gravidarum is limited. There is a need to set a protocol to manage females with more effective drugs and fewer side effects. The results might help clinicians to reduce hyperemesis gravidarum and its related complications in pregnancy.

METHODOLOGY

It was a quasi-experimental study conducted in the Department of Gynaecology & Obstetrics, Services

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Received: March 22, 2022; Accepted: May 12, 2022

Hospital, Lahore. The study was completed in the period from March to August 2020. A total of 60 pregnant females were enrolled in the study. They were divided into two groups with 30 in each group who were selected after fulfilling the selection criteria. The study was approved by the hospital ethical board (Letter No: IRB/2020/629/SIMS, 07-02-2020). All patients were included after informed consent by consecutive sampling technique. All pregnant females of age 18-40 years, parity <5, and duration of 6-14 weeks pregnancy based on last menstrual period presenting with hyperemesis gravidarum were included in this study. Patients diagnosed with diabetes mellitus, hypertension, multiple gestations, and allergic to medication were excluded from the study. Detailed biodata of patients including their age, parity, gestational age, and educational status was mentioned on the designed proforma. In the ondansetron group, females were given a single dose of 4 mg ondansetron in 100 mL of normal saline. In the metoclopramide group, a single dose of 10 mg metoclopramide in 100 mL of normal saline was given. Then females were followed-up in the gynecology ward for 24 hours. Patients were assessed for improvement of symptoms after 24 hours. Pregnancy-unique quantification of emesis (PUQE) was used to assess the severity of nausea and vomiting. It is a validated tool and focuses on the number of vomiting episodes daily and the length of nausea in hours per day.[11]

STATISTICAL ANALYSIS

Data analysis was done through Statistical Package for the Social Sciences (SPSS) version 22. Quantitative variables including the age of the patient, gestational age, and nausea score were calculated as mean±SD. Qualitative variables such as vomiting episodes were presented as frequency and percentage. Parity was presented as frequency. The comparison between two groups for nausea scores was done using an independent t-test and Chi-square was used for vomiting episodes. A p-value ≤0.05 was considered significant.

RESULTS

A total of 60 patients were included in this study. The patients in the study had a mean age of 27.52±6.67 years. Out of them, 20(33.33%) patients were nulliparous in the study and 14(23.33%) had parity 1, 7(11.67%) patients had parity 2, 9(15%) had parity 3 and 10(16.67%) patients had parity 4.

Among the ondansetron group, vomiting was found in 13(43.3%) patients whereas in the metoclopramide group vomiting was found in 19(63.3%) patients within 24 hours after the administration of the drugs. The difference between the two study groups was not statistically significant (p- value=0.121).

The mean nausea score was 6.70±1.09 in subjects who took ondansetron while in patients who were given metoclopramide, the score was 6.40±1.33. This difference was also not significant (p-value=0.343).

Data was stratified and compared based on age, gestational age, body mass index (BMI) & parity of the study participants for vomiting episodes (Table 1).

Nausea score was also compared in both study groups, based on data stratification of age, gestational age, BMI & parity (Table 2). It was found that vomiting and nausea scores in both study groups and sub-groups did not differ significantly.

Table 1: Comparison of Vomiting during Last 24 Hours between Study Groups Stratified by Age, Gestational Age, BMI & Parity

Study Variables		Vomiting during the Last 24 Hours	Groups		Total	p-value
			Ondansetron	Metoclopramide		
Age (Years)	≤30	Yes	9(40.9%)	11(55%)	20(47.6%)	0.361
		No	13(59.1%)	9(45%)	22(52.4%)	
	>30	Yes	4(50%)	8(80%)	12(66.7%)	0.180
		No	4(50%)	2(20%)	6(33.3%)	
Gestational Age (Weeks)	12-14	Yes	6(42.9%)	14(73.7%)	20(60.6%)	0.073
		No	8(57.1%)	5(26.3%)	13(39.4%)	
	>14	Yes	7(43.8%)	5(45.5%)	12(44.4%)	0.930
		No	9(56.2%)	6(54.5%)	15(55.6%)	
BMI	≤25	Yes	9(47.4%)	10(52.6%)	19(50%)	0.746
		No	10(52.6%)	9(47.4%)	19(50%)	
	>25	Yes	4(36.4%)	9(81.8%)	13(59.1%)	0.030
		No	7(63.6%)	2(18.2%)	9(40.9%)	
Parity	Null & Primary	Yes	3(18.8%)	12(66.7%)	15(44.1%)	0.005
		No	13(81.2%)	6(33.3%)	19(55.9%)	
	Multiple	Yes	10(71.4%)	7(58.3%)	17(65.4%)	0.484
		No	4(28.6%)	5(41.7%)	9(34.6%)	

Table 2: Comparison of Nausea Score between Study Groups Stratified by Age, Gestational Age, BMI & Parity

Study Variables		Study Groups	Nausea Score	p-value
			Mean±SD	
Age (Years)	≤30	Ondansetron	6.77±1.11	0.402
		Metoclopramide	6.45±1.36	
	>30	Ondansetron	6.5±1.07	0.894
		Metoclopramide	6.3±1.34	
Gestational Age (Weeks)	12-14	Ondansetron	6.43±0.94	0.298
		Metoclopramide	6.37±1.46	
	>14	Ondansetron	6.94±1.18	0.944
		Metoclopramide	6.45±1.13	
BMI	≤25	Ondansetron	6.94±1.26	0.07
		Metoclopramide	6.33±1.38	
	>25	Ondansetron	6.82±0.75	0.818
		Metoclopramide	6.1±1.18	
Parity	Null & Primary	Ondansetron	6.75±1.00	0.451
		Metoclopramide	6.44±1.29	
	Multiple	Ondansetron	6.64±1.22	0.557
		Metoclopramide	6.33±1.43	

DISCUSSION

Nausea and vomiting are the most common presentations of patients in early pregnancy.[12] Majority of the cases (almost 80%) are managed conservatively but the symptoms affect the quality of life.[13] Severity of the symptoms in these patients is assessed by the PUQE score.[14] Hyperemesis gravidarum is a severe form affecting 0.3-1.0% of pregnancies.[15]

In our study, vomiting was found in 32(53.3%) patients within 24 hours of administration of drugs. In the ondansetron group, it was found in 13(43.3%) patients whereas in the metoclopramide group it was in 19(63.3%) patients. The difference between the two study groups was not statistically significant (p-value=0.121). In the ondansetron group, the mean nausea score was 6.70±1.09 while it was 6.40±1.33 in the metoclopramide group. This difference is not statistically significant (p-value=0.343). Similar results were found in a randomized control trial conducted by Boelig et al. They evaluated the efficacy of various antiemetics like metoclopramide, ondansetron, and promethazine. The results indicated that the efficacy and safety of all the drugs are comparable.[15] Another study conducted by Shapira et al. suggested that ondansetron is a safe treatment option for nausea and vomiting in pregnancy.[16]

A meta-analysis was conducted to investigate the efficacy of metoclopramide versus ondansetron in the treatment of hyperemesis gravidarum. Both groups were compared regarding the pregnancy-unique quantification of emesis & nausea score and a statistically significant difference was found. Both drugs have comparable efficacy.[17]

A large multi-centered cohort study concluded that there is no association between ondansetron and the risk of spontaneous abortion, fetal death, stillbirth, and congenital malformations. So, ondansetron can be used frequently to treat nausea and vomiting in pregnancy.[18]

Another study was conducted in Holy Family Hospital, Rawalpindi to compare the outcomes of ondansetron and metoclopramide. They included 230 pregnant females who presented with hyperemesis gravidarum. They were randomly divided into groups by lottery method. Group A included patients treated with ondansetron and group B with metoclopramide. The efficacy and safety of both drugs were observed and they concluded that the efficacy and safety of ondansetron are better than metoclopramide.[19]

A double-blind randomized clinical trial was conducted by Moradiha et al. They included 153 pregnant females who presented with nausea and vomiting. These patients were divided into metoclopramide and ondansetron groups. The severity of nausea and vomiting was assessed by the PUQE questionnaire. They concluded that ondansetron is an effective and safe alternative for metoclopramide in the treatment of hyperemesis gravidarum.[20] A study was conducted by Lonah et al. to assess the efficacy and cost of ondansetron and metoclopramide in the treatment of hyperemesis gravidarum. They found no significant

difference in the cost and effectiveness of ondansetron versus metoclopramide.[21]

CONCLUSION

Both ondansetron and metoclopramide are equally effective for the management of females presenting with hyperemesis gravidarum.

LIMITATIONS & RECOMMENDATIONS

Study needs to be seen in context of its limitations. Small sample size and data from single center remains the major limiting factor. However, similarities of the findings with international research suggest generalizability of these results. Further studies are recommended to see the efficacy of these drugs for longer duration, and evaluate the safety in terms of side effects.

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Original Article

Redisplacement of Distal Radius Metaphyseal Fractures in Children Treated with Kirschner Wire versus Cast Immobilization

Bilal Hussain, Waqas Ali, Muhammad Saleem Bashir, Muhammad Zahid Siddiq

ABSTRACT

Objective: To compare the frequency of redisplacement of distal radius metaphyseal fractures in children treated with Kirschner wire (K-wire) versus cast.

Methodology: It was a quasi-experimental study conducted at the Department of Orthopedic Surgery, Aziz Bhatti Shaheed Hospital, Gujrat from March to September 2019. After approval from the ethical review committee of the hospital, 139 children presenting with distal radius fractures were enrolled by convenient sampling technique and were divided into two treatment groups. After giving written informed consent, patients in the cast group were treated conservatively by cast while K-wire fixation was done in patients in the K-wire group. The outcome variable was the frequency of fracture redisplacement which was compared between the groups.

Results: The mean age of the patients was 8.76±3.60 years while the mean weight was 25.15±7.12 kg. There were 91(65.5%) male and 48(34.5%) female patients with a male to female ratio of 1.9:1. Redisplacement of fracture occurred in 32(23%) patients. The frequency of redisplacement was significantly lower in patients who were treated with K-wire (7.1%) as compared to cast (39.1%). The patients in both groups did not differ significantly in their age, weight, and gender (p-value <0.001).

Conclusions: K-wire is a stable and more effective treatment option for children with distal radius fractures as compared to cast immobilization. There is a significantly lower frequency of fracture redisplacement with K-wires than casting.

Keywords: *Distal radius fractures. Kirschner wire. Plaster of Paris cast.*

INTRODUCTION

Distal radius fractures occur commonly in children affecting almost 372 in 100,000 children.[1] Children above five years of age are more frequently involved, with the peak incidence in boys from 12 to 14 years and in girls from 10 to 12 years. The most common cause of these fractures is fall or trauma. Low bone mineral density and obesity are the predisposing factors.[2] The clinical manifestations of the patients are pain & tenderness in the wrist, swelling, deformity, reduced movement of the forearm & wrist, and decreased grip strength. These fractures should be carefully evaluated for any associated injuries, open fractures, vascular compromise, compartment syndrome, or neuropathy. Radiographs of the forearm both posteroanterior (PA) and lateral view detect distal radius fractures. These fractures are frequently missed in the emergency on plain radiographs. Computed tomography and magnetic resonance imaging (MRI) are useful for this purpose although they are not done on a routine basis.[3]

Conservative management is the main treatment modality for these fractures.[4] The other treatment options are operative management using Steinmann pin, Kirschner wire, volar locking plate, and external fixation.[5] The management aim is to restore wrist function with normal mechanics of radioulnar and radiocarpal joints. Inadequate fixation and malalignment can lead to osteoarthrosis, deformity, and impaired function of the wrist.[4]

Redisplacement, malunion, physeal arrest, and loss of forearm movements are complications that may occur in conservative management. The K-wire fixation is associated with decreased redisplacement rates but it can cause pin tract infection and neuropraxia.[6] In total, 30% of the complete fractures are unstable and predominantly present with malunion due to failure to maintain successful closed reduction. The contraindications of conservative management include fractures with massive swelling, neurovascular compromise, compartment syndrome, open fractures, and redisplacement after conservative treatment.[7]

The standard treatment practice is traction and cast application in distal radius metaphyseal fractures, but it carries a significantly greater frequency of redisplacement which can lead to malunion, growth arrest, and even the restriction of the movement of the forearm. The data comparing the frequency of replacement with conservative and operative treatment in distal radius fractures is lacking in Pakistan. This study was conducted to determine the best treatment plan which can help in reducing the morbidity associated with this complication.

METHODOLOGY

It was a quasi-experimental study conducted at the Department of Orthopedic Surgery, Aziz Bhatti Shaheed Hospital, Gujrat from March 2019 to February 2020. The study was approved by the ethical review

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Received: March 28, 2022; Accepted: June 30, 2022

committee of the hospital (Letter No: UOG/ORIC/2018/602, 25-09-2018). One hundred and thirty nine cases were enrolled in the study using a convenient sampling technique. After obtaining written informed consent, 70 patients were included in the K-wire group and 69 cases were included in the cast group. Their demographic details and clinical history were noted on a proforma sheet. Patients of either gender with age ranging from 4 to 16 years presenting with a history of fall, clinical manifestations of distal radius fractures, and X-ray findings suggestive of fracture were included in the study. Patients who previously had a fracture of the radius as per clinical record and involvement of growth plate or joint deformity on X-ray findings at the time of presentation were excluded. In the cast group, traction and cast were applied as per standard protocol, and a post-cast X-ray was done to see the alignment of the fracture ends. Patients were sent home if the discrepancy was less than 2 mm and the cast was removed after 4 weeks. K-wire fixation was done under general anesthesia by using an image intensifier. The wire was removed after 4 weeks. The patients were followed-up for 6 months on a regular basis and redisplacement was noted.

All the distal radius fractures were managed by the same Orthopedic Consultant to eliminate bias and confounding variables were controlled by exclusion. On X-ray displacement of the radius at the radioulnar plane which was >1/3rd the diameter of the bone or angulations of >20 degree that occured within <6 months of treatment was labeled as redisplacement.[6]

STATISTICAL ANALYSIS

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Numerical variables such as age were presented by mean±SD. Categorical variables i.e. gender and redisplacement were presented by frequency and percentage. A Chi-square test was applied to compare redisplacement between the two groups and to see the association of redisplacement with patient age, gender, and weight. A p-value of ≤0.05 was considered statistically significant.

RESULTS

The mean age of the patients was 8.76±3.60 years with the range of 4 to 16 years. The weight ranged from 14 to 39 kg with a mean of 25.15±7.12 kg. There were 91(65.5%) males and 48(34.5%) females in the study with a male to female ratio of 1.9:1 (Table 1). The patients in both groups did not differ significantly in their age, weight, and gender (p-value >0.05).

Redisplacement occurred in 32(23%) patients. The frequency of redisplacement was significantly lower in patients who were treated with K-wire in contrast to cast. Twenty seven (39.1%) patients developed redisplacement in the cast group. On the other hand, only 5(7.1%) patients had redisplacement in the K-wire group. The difference was statistically significant with a p-value of <0.001 (Table 2). The fracture redisplacement was also significant between the two groups based on the age, weight, and gender of the participants. The frequency of fracture redisplacement was significantly higher in the cast group as compared to the K-wire group in patients of all ages, gender & weight. These results are shown in Table 3.

Table 1: Demographic Profile of the Study Participants

Demographic Variables		Frequency & Percentage
Age Groups (Years)	**4-10**	84(60.4%)
	11-16	55(39.6%)
Gender	**Male**	91(65.5%)
	Female	48(34.5%)
Weight (Kilogram)	**14-26**	75(54%)
	27-39	64(46%)

Table 2: Frequency of Redisplacement of Fractures in the Study Groups

Redisplacement	K-Wire Group (n=70)	Cast Group (n=69)	p-value
Present	5(7.1%)	27(39.1%)	<0.001*
Absent	65(92.9%)	42(60.9%)	
Total	**70(100%)**	**69(100%)**	

**Significant p-value*

Table 3: Association of Fracture Redisplacement with Demographic Variables

Demographic Variables		Redisplacement of Fracture		p-value
		K-Wire Group (n=70)	Cast Group (n=69)	
Age Groups (Years)	4-10	3/43 (7%)	16/41 (39%)	<0.001*
	11-16	2/27 (7.4%)	11/28 (39.3%)	0.005*
Gender Frequency & Percentage	Male	3/45 (6.7%)	18/46 (39.1%)	<0.001*
	Female	2/25 (8%)	9/23 (39.1%)	0.010*
Weight (Kilogram)	14-26	2/37 (5.4%)	15/38 (39.5%)	<0.001*
	27-39	3/33 (9.1%)	12/31 (38.7%)	0.005*

**Significant p-value*

DISCUSSION

Distal fractures of the radius account for the majority of the cases of orthopedic surgical intervention in the pediatric population. Although these fractures are mostly managed with conservative treatment, one of the most significant complications of conservative management is loss of reduction or redisplacement. Most of the patients managed conservatively, develop redisplacement which requires repeated nonsurgical or surgical manipulations.[8] The treatment modality is selected according to the patient's age, fracture type, and surgeon's choice. Despite being the most common fracture in children, there is still no consensus about the protocol of management and follow-up of these fractures.[9]

Our results showed that redisplacement was significantly lower in patients who were treated with K-wire fixation as compared to cast immobilization. Twenty seven (39.1%) patients developed redisplacement in the cast group. On the other hand, only 5(7.1%) patients had redisplacement in the K-wire group. The difference was statistically significant with a p-value of <0.001.

Similar results were reported in another study conducted by Sengab et al. They suggested that K-wire fixation is the best treatment option to prevent redisplacement and secondary operations after anatomical reduction and cast immobilization but cast immobilization had a better range of motion as compared to K-wire.[6] LaValva et al. preferred surgical intervention over conservative modality in distal radius fractures in an attempt to reduce repeated episodes of manipulation and malunion.[10]

Another study showed that in patients with dorsally displaced distal radius fracture, surgical fixation with K-wires did not improve the wrist function of patients even after 12 months as compared to the cast.[11]

A study conducted in 2021 by Marson et al. reported that conservative management in children with completely displaced distal radial fractures results in better outcomes as compared to surgical treatment.[12]

A case report showed that a displaced distal radius fracture of a 7 year-old boy was managed with K-wire fixation who developed chronic osteomyelitis afterwards. So, K-wire fixation in uncomplicated closed fractures should only be considered in children above 10 years of age and in patients in whom anatomical reduction cannot be achieved.[13]

A retrospective study included 61 children with displaced distal radius fractures. Eight patients were surgically treated with K-wire fixation and fifty three patients were managed with reduction and casting. Redisplacement was noted in both groups during follow-up. Redisplacement was reported in 18.8% of patients treated with cast immobilization and no redisplacement was seen in patients treated with K-wire fixation. The study suggested that redisplacement occurs due to non-anatomical reduction and poor casting technique. If the anatomical reduction is not achieved, K-wire is the best treatment potion.[14]

A systematic review suggested that in pediatric radial fracture management, cast immobilization is a successful treatment modality. Surgical intervention is recommended only when the fracture cannot be reduced appropriately.[15]

A randomized controlled trial was conducted in Sahiwal Medical College, Sahiwal, Pakistan to compare the outcome of K-wire fixation and cast immobilization for the treatment of distal radius fracture. They included 100 patients, 50 patients were treated surgically with K-wire fixation and 50 were managed with a plaster of Paris cast. It was reported that a better outcome was achieved after K-wire as compared to cast in the management of distal radius fracture.[16]

A review conducted by Truong et al. included two studies and found that loss of reduction was 0% in both studies when surgical treatment was performed. In patients treated with cast immobilization redisplacement ranged from 21-39%. Some minor complications found in surgically treated groups were site infection, tendon irritation, pin migrating under the

skin, and transient hypoesthesia. The review concluded that surgical treatment is preferred over casting alone.[17]

CONCLUSION

K-wires are a stable and more effective treatment option for children with distal radius fractures as compared to cast immobilization. There is a significantly lower frequency of fracture redisplacement with K-wires than casting. The surgical intervention using K-wires is preferred in future orthopedic practice as it is a simple, low-cost procedure with improved outcomes.

LIMITATIONS & RECOMMENDATIONS

It was a single-centered study in which two treatment modalities for distal radius fractures in terms of risk of redisplacement were studied. Other complications such as neurovascular injury and infection were not compared. Further multi-centered studies to establish the safety of the procedure in terms of other complications are recommended.

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Original Article

Antimicrobial Activity of Zingiber officinale (Ginger) and Allium sativum (Garlic) Against *Escherichia coli, Staphylococcus aureus,* and *Pseudomonas aeruginosa*

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ABSTRACT

Objective: To evaluate the antimicrobial activity of ethanol extracts of ginger and garlic against *Escherichia coli*, *Staphylococcus aureus,* and *Pseudomonas aeruginosa* and compare them with antibiotics used to treat infections caused by these bacteria.

Methodology: It was a quasi-experimental study conducted at the Microbiology Department & Biochemistry Laboratory of Hazrat Bari Imam Sarkar Medical and Dental College, Islamabad from October 2021 to January 2022. After getting ethical approval from the Institutional Review Board, ethanol extracts of ginger and garlic were prepared and tested against *Staphylococcus aureus, Escherichia coli,* and *Pseudomonas aeruginosa.* The isolates were also tested against antimicrobials; ceftriaxone, oxacillin, and piperacillin/tazobactam for *Escherichia coli*, *Staphylococcus aureus,* and *Pseudomonas aeruginosa*, respectively. Data analysis was done using the Statistical Package for the Social Sciences (SPSS) version 25.

Results: Among all ginger & garlic extracts and antimicrobials, the most significant zone of inhibition was produced by ginger day 3 extract against all bacterial isolates. The one-way ANOVA test showed a significant difference in the zone diameters of day 3 ginger extract compared to other extracts and antimicrobials (p-value <0.01).

Conclusion: Ethanol extracts of ginger and garlic have significant antimicrobial activity and inhibit the growth of *Escherichia coli, Staphylococcus aureus,* and *Pseudomonas aeruginosa*. The most effective is the day 3 ginger extract producing the most significant zone of inhibition against all bacterial isolates as compared to day 3 garlic extract, day 9 garlic & ginger extracts, and antimicrobials.

Keywords: *Antimicrobial activity. Garlic. Ginger.*

INTRODUCTION

Plants have been in continuous use for centuries for essential oil preparation because of their application in medicine, pharmaceutics, food industries, and biotechnology.[1,2] Ginger and garlic are not only used as spices in food but also in medicine due to the presence of various bioactive substances.[3] Besides, these two herbs are cheap, easy to obtain and have almost no profound side effects documented. Ginger and garlic have antioxidant, antifungal, and antibacterial properties.[4]

Many studies found that garlic and ginger have a beneficial effect in reducing pain, inflammation, fever, and ulcers. They also decrease serum cholesterol and gastric motility in nausea. They have an effective role in allergies, thrombosis, osteoporosis, osteoarthritis, rheumatoid arthritis, degenerative diseases, atherosclerosis, and coronary diseases. Because of their activity against various viral, bacterial and parasitic pathogens, these herbs are found to be effective against these infectious agents.[5]

Antibiotic resistance has emerged as a global health concern due to the overuse of antibiotics. It is a major threat because a few options of antimicrobials are left for treatment. The new antimicrobials are not being synthesized at the same rate that bacteria are developing resistance to them.[6] Various non-antibiotic approaches can be used to treat and prevent various infections, for example, probiotics, bacteriophages, phytomedicines, and plants (herbs). The use of plants and herbs in medicine is not a new concept, but they have been used to cure different infectious and non-infectious diseases for a long time globally.[7] The World Health Organization reported that almost 80% of people all around the world are dependent on traditional medicine in which different plant extracts and herbs are used.[3] Ginger and garlic are also among these plant extracts.[8]

Based on the antimicrobial properties of garlic and ginger, we hypothesized that their antimicrobial activity would be beneficial in our geographical region. A few studies have been done in Pakistan to observe the antimicrobial spectrum of ginger and garlic. Therefore, we aimed our study to use 95% ethanol for the preparation of ginger and garlic extracts and study their antimicrobial activity against *Escherichia coli* (*E. coli*), *Staphylococcus aureus* (*S. aureus*), and *Pseudomonas aeruginosa* (*P. aeruginosa*). Their antimicrobial activity was compared with antibiotics used to treat infections caused by these bacteria.

METHODOLOGY

It was a quasi-experimental study conducted at the

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Received: April 29, 2022; Accepted: June 16, 2022

Microbiology Department & Biochemistry Laboratory of Hazrat Bari Imam Sarkar Medical and Dental College, Islamabad after approval from the Institutional Review Board (Letter No: EC, 01/27/09/2021, 27-09-2021). Fresh garlic and ginger were obtained. Their raw forms were peeled, cut into tiny pieces, and air-dried at room temperature for 7 days. Then they were grounded by mortar and pestle. Two preparations of ginger were made by putting 20 grams of ginger in 400 ml of 95% ethanol in each beaker. Similarly, two garlic preparations were made by adding 20 grams of garlic in 400 ml of 95% ethanol in each beaker. The preparations were stirred intermittently with a glass rod in a dark place at room temperature. One of the ginger and garlic preparations was filtered on the 3rd day and the other on the 9th day using a Whatman filter paper number 1. The supernatant filtrate of extractions was labeled and used for the present study.

Sterile filter paper discs were purchased. Stock solutions of ginger and garlic were made by dissolving 0.5 g of each ginger and garlic in 5 ml of dimethyl sulphoxide. The stock solution had a concentration of 10,000 mg/mL. The extracts of 100 µg/ml concentration were prepared from the stock solution. The sterile discs were dipped in the extracts overnight and then put in a sterile petri dish for drying. In addition to these discs, the antibiotics used were ceftriaxone (1 µg) for *E. coli*, oxacillin (30 µg) for *S. aureus*, and piperacillin/tazobactam (100/10 µg) for *P. aeruginosa*.

The antimicrobial properties of ginger and garlic extract were tested against three bacterial species: *Staphylococcus aureus* (Gram-positive bacteria), *Escherichia coli,* and *Pseudomonas aeruginosa* (Gram-negative bacteria). The cultures were taken from the Microbiology Department of Pathology Laboratory of HBS Hospital by non-probability sampling technique. Informed consent was taken from the patients whose samples were used in the study. The bacterial strains were preserved in agar slants and stored in the refrigerator at 4°C.

The antimicrobial activity was evaluated using the Kirby-Bauer method. The suspension of each organism was made by mixing 2-3 well-isolated colonies into a tube of normal saline using a sterile wire loop. The turbidity of each suspension was then matched to the 0.5 McFarland turbidity standard. Next, the suspension was inoculated into the nutrient agar plate, and then discs were applied. The plates were incubated aerobically at 35-37°C for 24 hours. After 24 hours of incubation, inhibition zones were measured in millimeters.[9]

STATISTICAL ANALYSIS

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 25.0. The zones of inhibition of day 3 ginger & garlic extracts, day 9 ginger & garlic extracts, and antimicrobials were calculated as mean and standard deviation (SD). One-way analysis of variance (ANOVA) followed by a post-hoc Tukey's test was applied to compare the means of different groups. A p-value of ≤0.05 was considered statistically significant.

RESULTS

Our results showed that the greatest zone of inhibition was produced by ginger day 3 extract against all bacterial isolates among all ginger and garlic extracts. The zone of inhibition of ginger day 3 extract was even greater than that of antimicrobials. The mean zone of inhibition of ginger day 3 extract was 41.4±2.8 mm as compared to the mean zone of inhibition of ceftriaxone (33.5±1.6 mm) for *E. coli*. The mean zone of inhibition of ginger day 3 extract was 44.8±3.8 mm as compared to the mean zone of inhibition of oxacillin (36.7±3 mm) for *Staphylococcus aureus*. Similarly, for *Pseudomonas aeruginosa*, ginger day 3 extract exhibited a zone diameter of 34.6±2.6 mm, whereas the strain was resistant to piperacillin/tazobactam showing a 0 mm zone diameter. The one-way ANOVA test showed a significant difference in the zone diameters of day 3 ginger extract compared to day 3 garlic extract, day 9 garlic & ginger extract, and antimicrobials with a p-value of <0.01. The mean zones of inhibition and one-way ANOVA test results for all the bacterial isolates are shown in Table 1.

Post-hoc Tukey's analysis showed that the ginger day 3 extract has the highest antimicrobial activity against *E. coli* than the ceftriaxone, ginger day 9 extract, garlic day 3, and day 9 extract ($p < 0.01$). There is no significant difference between the antimicrobial activity of garlic day 3 extract with ginger day 9 extract ($p > 0.05$). All others have significant differences from each other ($p < 0.01$) (Figure 1).

One-way ANOVA followed by post-hoc Tukey's analysis showed that the ginger day 3 extract has the highest antimicrobial activity against *S. aureus* than oxacillin, ginger day 9 extract, garlic day 3 extract, and garlic day 9 extract ($p < 0.01$). There is no significant difference between ginger day 9 extract and garlic day 9 extract ($p > 0.05$). All others have significant differences from each other ($p < 0.01$) (Figure 2).

Data analysis showed ginger day 3 extract has the highest antimicrobial activity against *P. aeruginosa* than the piperacillin/tazobactam, ginger day 9 extract, garlic day 3 extracts, and garlic day 9 extract ($p < 0.01$). Piperacillin/tazobactam has no antimicrobial activity. There is no significant difference between the antimicrobial activity of ginger day 9 extract with garlic day 9 extract against *P. aeruginosa* ($p > 0.05$). All others have significant differences from each other ($p < 0.01$) (Figure 3).

Table 1: Mean Zones of Inhibition & One-Way ANOVA Test Results for all Bacterial Isolates

Escherichia coli					
	Garlic (Mean±SD)	**Ginger (Mean±SD)**	**Ceftriaxone (Mean±SD)**	**f (6.77)**	**p-value**
Day 3	13.1±2.1 mm	41.4±2.8 mm	33.5±1.6 mm	580	<0.01***
Day 9	20±3.5 mm	11.8±1.6 mm	34.8±1.9 mm		
Staphylococcus aureus					
	Garlic (Mean±SD)	**Ginger (Mean±SD)**	**Oxacillin (Mean±SD)**	**f (6.77)**	**p-value**
Day 3	12.2±1.5 mm	44.8±3.8 mm	36.7±3 mm	431	<0.01***
Day 9	14.8±2 mm	20.2±1.9 mm	37.2±4.3 mm		
Pseudomonas aeruginosa					
	Garlic (Mean±SD)	**Ginger (Mean±SD)**	**Tazobactam (Mean±SD)**	**f (6.77)**	**p-value**
Day 3	9.3±1.9 mm	34.6±2.6 mm	0±0 mm	626	<0.01***
Day 9	21.6±3.4 mm	19.8±1.8 mm	0±0 mm		

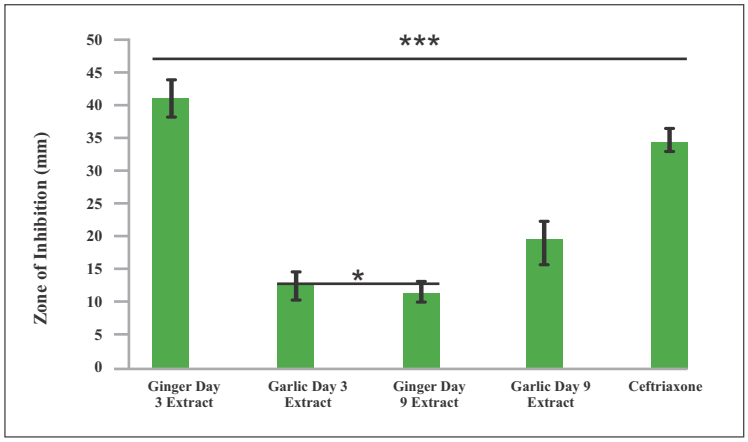

Figure 1: Bar Chart of the Mean Zone of Inhibition (mm) of Ginger & Garlic Extracts and Ceftriaxone Against *E. coli*

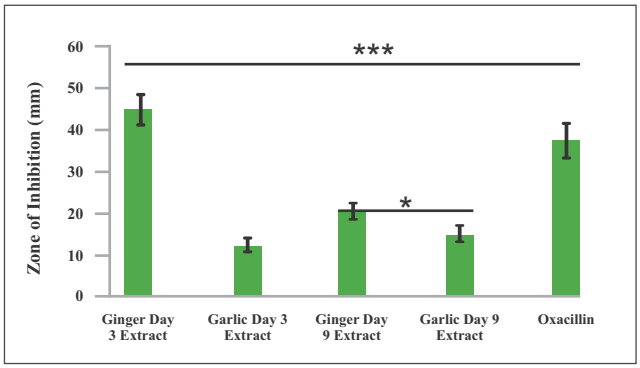

Figure 2: Bar Chart of the Mean Zone of Inhibition (mm) of Ginger & Garlic Extracts and Oxacillin Against *S. aureus*

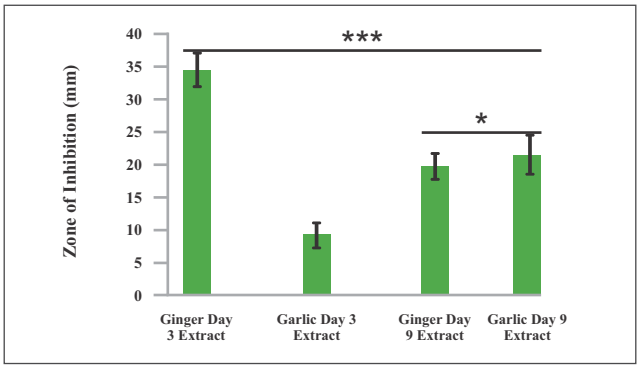

Figure 3: Bar Chart of the Mean Zone of Inhibition (mm) of Ginger & Garlic Extracts and Piperacillin/Tazobactam Against *P. aeruginosa*

** p-value >0.05*
**** p-value <0.01*

DISCUSSION

Ginger and garlic are of particular interest to scientists for ages and are gaining popularity due to their antimicrobial activities.[10] The World Health Organization (WHO) reported that almost 80% of people are using traditional medicine based on plant-based medications.[11] Ginger contains various compounds such as zingerone, zingiberene, camphene, and phellandrene which contribute to its antimicrobial properties.[3] The antimicrobial activity of garlic is chiefly due to sulphur containing compound, Allicin. When garlic is crushed or cut into tiny pieces, the alliinase enzyme converts alliin into allicin.[12] The antimicrobial activity of ginger and garlic depends on the solvent and method used for extraction and the amount of bioactive compounds.[8,10]

Our study investigated the antimicrobial activity of ethanol extracts of ginger and garlic. Our results showed that day 3 ginger extract showed the maximum antimicrobial activity against *E. coli*, *S. aureus*, and *P. aeruginosa*. The mean zone of inhibition of ginger day 3 extract was 41.4±2.8 mm for *E. coli*, 44.8±3.8 mm for *S. aureus,* and 34.6±2.6 mm for *P. aeruginosa*. Antimicrobial activity of Allium sativum of garlic and Zingiber officinale of ginger against both clinical and laboratory isolates of *Staphylococcus aureus* were studied in Madonna University Teaching Hospital, Nigeria. The study showed that both garlic and ginger extract was effective against *Staphylococcus aureus*. However, ginger produced a greater zone of inhibition for *Staphylococcus aureus* (16.0±0.21 mm) than garlic (11.5±0.69 mm) at the concentration of 100 µg/ml.[13] Sikrodia et al. reported that the aqueous extract of ginger showed zones of inhibition of 20 mm for *E. coli* and 15 mm for *Staphylococcus aureus*. In contrast, garlic extracts did not show any zone of inhibition. The zones of inhibition of gentamicin, ampicillin plus sulbactam, and ciprofloxacin were 20, 16, and 30 mm for *E. coli*, and 17, 22, and 20 for *Staphylococcus*, respectively.[9]

Some studies reported contradictory results as compared to other studies. A study conducted by Emmanuel et al. revealed that aqueous garlic extract had the highest antimicrobial activity against *Staphylococcus aureus*, *Salmonella typhi*, and *Pseudomonas aeruginosa* whereas ethanol extract of ginger showed the highest zone of inhibition against *E. coli.* Overall, the aqueous, methanol, and ethanol extracts of ginger showed better inhibition zones than various extracts of garlic except the aqueous extract of garlic. The aqueous extract of garlic was most effective as compared to other garlic extracts whereas the ethanol extract of ginger showed the highest antimicrobial activity among all the ginger extracts.[14] A study conducted in Bangladesh evaluated the antimicrobial activity of aqueous, methanol, and propranolol extracts of garlic and ginger against *Staphylococcus aureus* and *Klebsiella pneumoniae.* The greatest antibacterial activity was exhibited by the aqueous extract of garlic against *Staphylococcus aureus* (25 mm).[15] A study was conducted in Nigeria to assess the antimicrobial activity of n-hexane and methanol extracts of ginger and garlic against *E. coli, Shigella*, *Salmonella*, and *Klebsiella.* They found that all organisms were susceptible to extracts of ginger and garlic due to the presence of bioactive compounds in them. The study also reported that garlic extracts had higher antimicrobial activity for *E. coli* than the hexane and methanol extracts of ginger.[16] Another study revealed that aqueous extract of garlic exhibited a zone diameter of 15 mm against *E. coli*, 21 mm for *Staphylococcus aureus*, and 19 mm against *Pseudomonas*. The aqueous extract of garlic exhibited a stronger antimicrobial effect as compared to ginger & turmeric against *Staphylococcus, E. coli* & *Pseudomonas*.[17]

CONCLUSION

Ethanol extracts of ginger and garlic have significant antimicrobial activity and inhibit the growth of *E. coli*, *S. aureus,* and *P. aeruginosa*. The most effective is the day 3 ginger extract producing the greatest zone of inhibition against all bacterial isolates as compared to day 3 garlic extract, day 9 garlic & ginger extract; and antimicrobials. This is a finding which guides us toward the pattern of behaviors of bioactive compounds in ginger.

LIMITATIONS & RECOMMENDATIONS

The study did not compare the antimicrobial activity of ethanol extracts of ginger and garlic with other ginger and garlic extracts such as aqueous or methanol extracts. The antimicrobial activity of various dilutions of ginger & garlic extracts was not evaluated in the study. Further studies can guide clinicians towards better use of the antimicrobial activity of these herbs. However, the side effects and pharmacokinetic properties of these plants should also be explored.

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Original Article

Anemia as a Predictor of Poor Outcome in Hospitalized Patients of COVID-19

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ABSTRACT

Objective: To find an association between anemia & outcome of COVID-19 in hospitalized patients.

Methodology: This retrospective cross-sectional study was conducted at The University of Lahore Teaching Hospital, Lahore. Two hundred and ten patients with age ≥18 years and who tested positive for COVID-19 on polymerase chain reaction (PCR) were included. These patients were admitted to the COVID-19 ward and intensive care unit (ICU) of The University of Lahore Teaching Hospital from January to December 2021. Complete blood count reports at the time of admission were evaluated and hemoglobin (Hb) & mean corpuscular volume (MCV) levels were noted. COVID-19 outcomes of these patients in terms of discharge from the hospital, ICU admission, and death were recorded.

Results: In this study, the mean age of the patients was 61.60±13.39 years. The majority of the patients [109(51.9%)] were greater than 60 years of age. There were 94(44.8%) anemic patients. Out of 210, 43(20.1%) patients died and 167(79.5%) were discharged. Out of 43 mortalities, 30(69.8%) patients were anemic. So, there was a significant association noted between anemia & outcome in hospitalized COVID-19 patients in terms of mortality (p=0.00).

Conclusion: The majority of COVID-19 affected patients were anemic at the time of hospitalization and it was associated with poor COVID-19 outcomes in terms of mortality

Keywords: *Anemia. COVID-19. Mortality.*

INTRODUCTION

COVID-19 caused by a novel coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in the city of Wuhan, China, and spread all over the world. It was declared a pandemic by World Health Organization. The COVID-19 disease presents with a variety of symptoms ranging from mild flu and anosmia to severe pneumonia leading to thromboembolism, respiratory failure, and death. It has been observed that male gender, obesity, and elderly patients have increased morbidity and mortality.[1]

Literature showed that anemic patients had a greater risk of disease and mortality. Various recent studies have observed a relationship between COVID-19 mortality and anemia, with varied outcomes.[2,3] According to the World Health Organization (WHO), anemia is defined as a Hb concentration of less than 13 g/dL in males and 12 g/dL in females. The prevalence of anemia was 22.8% globally in 2019, a decrease from 27.0% in 1990. However, anemia is still a major health issue worldwide, accounting for 60,534 deaths and affecting 3.4 percent of women aged 15-49 years globally.[4] Infection caused by novel coronavirus causes increased release of interleukins and inflammatory biomarkers such as ferritin, C-reactive protein, and lactate dehydrogenase along with a deranged coagulation profile. This inflammation can decrease intestinal absorption of iron in COVID-19 patients leading to reduced iron availability for erythropoiesis and hemoglobin production causing anemia which further decreases oxygen delivery to peripheral tissues in COVID-19 patients who already have an increased oxygen demand due to interstitial pneumonia.[5]

It was observed in a study of 67 COVID-19 patients in Singapore that serious patients who were admitted to the ICU had lower hemoglobin levels compared to relatively less serious patients who were admitted to wards.[6] Another research on COVID-19 elderly patients revealed that the majority of these patients had hemoglobin levels below the normal limit, but the study did not find a significant association between anemia and mortality.[7]

COVID-19 is currently a global public health problem. Some studies showed an association of COVID-19 morbidity & mortality in admitted patients and low hemoglobin levels at the time of admission but few studies in Pakistan correlate anemia and mortality in COVID-19 hospitalized patients. Therefore, the rationale of the current study was to find a relationship between anemia & COVID-19 in hospitalized patients in Lahore, Pakistan.

METHODOLOGY

This retrospective cross-sectional study was conducted at The University of Lahore Teaching Hospital, Lahore. Institutional review board approval was taken (Letter No: ERC/106/22/4, 13-04-2022). Two hundred and ten patients with age ≥18 years and who tested positive for COVID-19 on PCR were included. These patients were admitted to the COVID-19 ward and

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Received: April 12, 2022; Accepted: June 8, 2022

ICU of The University of Lahore Teaching Hospital from January to December 2021. Patients diagnosed with COVID-19 infection having a breathing rate of 30/min or more at rest and room air oxygen saturation (SpO2) of ≤93% were admitted. A questionnaire was used to record patients' demographic data, complete blood count reports, and hospital stay in all COVID-19 related units. Data with incomplete information was excluded. Complete blood count reports at the time of admission were evaluated and Hb & MCV levels were noted. Male patients with hemoglobin levels below 13 g/dL and females with hemoglobin less than 12 g/dL were considered anemic. The outcomes of COVID-19 in terms of discharge from the hospital, ICU admission, and death were recorded.

STATISTICAL ANALYSIS

Data was analyzed in Statistical Package for the Social Sciences (SPSS) version 24. Age, Hb level, and mean corpuscular volume (MCV) level were presented as mean and standard deviation (SD). Gender, admission in the ward, discharge, and ICU admission were presented as frequency and percentage. Chi-square test was used to find association and a p-value of ≤0.05 was taken as significant.

RESULTS

Out of 210 patients, 130(61.9%) were males and 80(38.1%) were females. The mean age was 61.60±13.39 years. There were only 31(14.8%) patients between the ages of 20 to 40 years. The majority of the patients 109(51.9%) were older than 60 years of age. There were 94(44.8%) anemic patients. Out of 210, 43(20.1%) patients died and 167(79.5%) were discharged (Table 1).

The mean oxygen saturation level at admission was 85.10±14.62%. There were 51(24.28%) patients hospitalized at room air and 159(75.72%) required oxygen. The mean Hb level was 13±1.91 g/dL and MCV was 81.2±7.41 fL. Data showed that only MCV had a significant relationship with anemia ($p < 0.05$)

In COVID-19 patients, more males were anemic as compared to females. There was a significant association between anemia & gender observed (p=0.026). Above 60 years of age, patients were mostly anemic but there was no significant association observed between age & anemia (p=0.16).

Out of 43 mortalities, 30(69.8%) patients were anemic. So, there was a significant association between anemia & mortality (p=0.00). The frequency of ICU admission (anemic: 29(48.3%) versus nonanemic: 31(51.7%)), had an insignificant association with anemia (p=0.510) (Table 2).

DISCUSSION

COVID-19 is a rapidly spreadable disease with high morbidity and mortality.[8] Various factors are related to poor outcomes in COVID-19 patients.[9] This study focused on the relationship between anemia and the outcome of COVID-19. Anemia frequently increases the severity of respiratory diseases and has been linked to poor outcomes.[1,5] It's an independent risk factor for COVID-19, thus healthcare providers should pay more attention to the hemoglobin levels of COVID-19 patients on admission.[6]

Our results showed that lower hemoglobin levels are associated with an increased risk of death in COVID-19 patients, regardless of age & gender. The majority of the patients [30(69.8%)] who died due to COVID-19 were anemic. There was a significant association between anemia & mortality (p=0.00). Anemia had an insignificant association with ICU admission (p=0.510). So, anemia may serve as an early indicator of poor outcomes in COVID-19 diseased patients. Similar results were found in other studies. Bellmann-Weiller et al. reported in their study conducted in Austria that 24.7% of patients were anemic on admission. Anemia was associated with high mortality

Table 1: Demographic Information of the Admitted Patients with COVID-19

Study Variables		Frequency & Percentage
Gender	**Male**	130(61.9%)
	Female	80(38.1%)
Age (Years)	**Mean±SD**	61.60±13.39
	20-40	31(14.8%)
	41-60	70(33.3%)
	>60	109(51.9%)
Anemia	**Yes**	94(44.8%)
	No	116(55.2%)
Outcome	**Died**	43(20.5%)
	Discharged	167(79.5%)

Table 2: Comparison of Anemia with Gender, Age Group, and Outcome

Study Variables		Anemia		p-value
		Yes Frequency & Percentage	No Frequency & Percentage	
Gender	Male	66(50.8%)	64(49.2%)	0.026*
	Female	28(35%)	52(65%)	
Age Groups (Years)	20-40	16(51.6%)	15(48.4%)	0.16
	41-60	36(51.4%)	34(48.6%)	
	>60	42(38.5%)	67(61.5%)	
Outcome	Died	30(69.8%)	13(30.2%)	0.001*
	Discharged	64(38.3%)	103(61.7%)	
COVID-19 Inpatients Areas	ICU	29(48.3%)	31(51.7%)	0.510
	Ward	65(43.3%)	85(56.7%)	

**Significant p-value*

(p=0.001) but it was not associated with increased ICU admissions.[5] Faghih Dinevari et al. showed a prevalence of anemia in 48% of hospitalized COVID-19 patients. They also reported that ICU admissions were significantly more in anemic patients (p <0.001).[10] Another study conducted in Italy found no relationship between anemia & poor COVID-19 outcomes.11 Similarly, Yang et al. also observed no link between anemia and morbidity & mortality associated with COVID-19 patients.[12]

In this study, we found a significant association of gender with anemia. Our results showed that the majority of COVID-19 male patients were anemic and the association of anemia with age is not significant. In contrast to these results, another study reported that the prevalence of anemia in COVID-19 positive patients is high in females and the association of age & gender with anemia is significant.[12]

Furthermore, our findings revealed that anemic patients were much more vulnerable to critical care ICU admissions. A meta-analysis conducted by Henry et al. reported that anemia is a significant factor in ICU admissions and mortality.[13]

Another study found anemia in 59.8% of patients which led to ICU admission and mortality.[14] Tremblay et al. found anemia in 30.9% of patients in their study and they also concluded that anemia is an independent predictor of morbidity and mortality in patients of COVID-19.[15]

Anemia is a major comorbidity in almost 25% of COVID-19 patients and is also associated with a significantly increased rate of mortality. From a pathophysiological point of view, Hb concentration exemplifies a vital component of oxygen-carrying capacity in the blood. Thus, anemia can further decrease oxygen delivery to peripheral tissue in COVID-19 patients who already have an increased oxygen demand due to interstitial pneumonia.[16] A study conducted by Jha et al. in India, observed a significant correlation between anemia and the severity of COVID-19. The study stated that anemia can be considered a single independent prognostic factor in COVID-19 patients.[17] Another study by Chen et al. comprehensively described a close relationship between anemia and the severity of COVID-19. They showed that patients of COVID-19 with concurrent anemia had an 8.2 times greater possibility of developing severe pneumonia.[18] All these studies potentiate the findings of our study.

CONCLUSION

The majority of COVID-19 affected patients were anemic at the time of hospitalization, and it was associated with poor COVID-19 outcomes in terms of increased mortality.

LIMITATIONS & RECOMMENDATIONS

There were several limitations to this study. Anemia was noticed at the time of admission but previous Hb levels were not noted. Other markers of inflammation like D-dimer and lactate dehydrogenase were not included in this study. This was a single-centered study, so it may not be an accurate reflection of the Pakistani population. Multi-centered study with hemoglobin levels known before COVID-19 at the time of presentation and during the hospital stay is recommended. Other inflammatory markers should be measured to accurately judge how anemia affects morbidity and mortality associated with COVID-19.

Our findings may have an important impact on daily clinical practice as the early identification of patients with anemia in COVID-19 assists in identifying at-risk patients who would require prioritization in treatment, close monitoring, and rectification of anemia.

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Original Article

Comparison of Postoperative Outcomes of Open Lichtenstein and Laparoscopic Transabdominal Preperitoneal Repair for Uncomplicated Unilateral Inguinal Hernia

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ABSTRACT

Objective: To compare the postoperative outcomes following open Lichtenstein's mesh repair and laparoscopic transabdominal preperitoneal (TAPP) repair for unilateral uncomplicated inguinal hernia.

Methodology: : It was a quasi-experimental study conducted at Sir Ganga Ram Hospital, Lahore from January to December 2021. A total of 88 patients were recruited with the non-probability consecutive sampling technique. Patients were divided into two groups. Patients in group A were operated by TAPP repair and group B was treated with Lichtenstein's mesh repair. The efficacies of both procedures were compared in terms of postoperative pain, hospital stay, operative time, seroma formation, infection, and recurrence.

Results: The mean ages of the patients in TAPP and Lichtenstein groups were 31.90±18.18 and 33.40±15.04 years, respectively. The majority of patients (62.5%) had a right-sided hernia. The mean operative time in the TAPP group was prolonged (76.4±13.1 min) as compared to the Lichtenstein group (56.4±11.3 min). The postoperative pain score at 8 hours in the TAPP group was 3.21±1.23 and in the Lichtenstein group, it was 4.84±1.41. The duration of hospital stay for the TAPP group was less as compared to Lichtenstein group (p-value <0.001). The majority of wound infections 4(4.55%) occurred in the Lichtenstein group. However, the incidence of seroma formation with scrotal edema was slightly higher in the TAPP group [10(11.35%)].

Conclusion: Transabdominal preperitoneal (TAPP) repair is more effective in terms of less pain, early recovery, and less seroma formation. However, the operative time was longer in TAPP group patients as compared to the Lichtenstein procedure.

Keywords: *:Inguinal hernia. Open hernioplasty. Laparoscopic hernioplasty.*

INTRODUCTION

Surgical repair of an inguinal hernia is one of the most common procedures performed by general surgeons. Approximately 20 million inguinal hernia repair surgeries are performed annually worldwide.[1] The incidence of the disease is about 25% in males and 2% in females and it can occur at any age.[2]

Various open surgical & laparoscopic techniques can be used for the treatment of inguinal hernia. The best-known open method for repairing inguinal hernias is Lichtenstein tension-free hernioplasty.[3] Literature proved this method of repair as an effective procedure in terms of early recovery, less hospital stays, and postoperative pain as compared to other open techniques of repair. Lichtenstein used mesh to repair which follows the basic principle of hernia repair that it should be tension-free. Among the open techniques, Lichtenstein free repair is considered to be a gold standard approach.[4]

Since the advent and the incorporation of a laparoscope as an alternate modality, laparoscopic repair has also gained popularity.[5] Transabdominal preperitoneal (TAPP) and total extraperitoneal (TEP) are two laparoscopic surgery techniques that are gradually replacing open techniques.[6] Laparoscopic repair of the inguinal hernia was started in 1999. It is a minimally invasive procedure and is a preferred procedure by surgeons.[7] Decreased postoperative pain, faster recovery, early return to normal activities, and better cosmetics have been recognized as definitive postoperative outcomes in laparoscopic surgeries.[8]

The introduction of a laparoscopic technique has started a debate over the superiority of the laparoscopic method. Laparoscopic repair is widely recommended for recurrent and bilateral hernias. Still, the ideal preferred approach is questionable. Therefore, we endeavored to conduct this study to compare the outcome of laparoscopic repair (TAPP) and open methods (Lichtenstein) for non-complicated unilateral hernias.

METHODOLOGY

This quasi-experimental study was conducted from January to December 2021 at the Department of Surgery, Sir Ganga Ram Hospital, Lahore. The study was approved by the ethical committee of the hospital (Letter No: 52-Synop-Surgery-II-FJ/ERC, 24-09-2020). A total of 88 patients were recruited with the non-probability consecutive sampling technique. Male patients presenting with primary uncomplicated unilateral direct or indirect inguinal hernia between the ages of 15-65 years were included. These patients also fulfilled the American Society of Anesthesiologists

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Received: May 16, 2022; Accepted: June 6, 2022

(ASA) I or II criteria. Patients with incarcerated or obstructed hernia requiring emergency surgery, previous history of pelvic surgery, and recurrent inguinal hernias were excluded. Informed consent was taken from all included patients. They were divided into two equal groups with 44 patients in each group. Group A was treated with the TAPP procedure and group B underwent Lichtenstein repair. A single dose of a second-generation cephalosporin antibiotic was administered half hour before surgery and all the patients received general anesthesia.

The transabdominal preperitoneal (TAPP) method of laparoscopic repair was used with a 3-port technique. An optical port was placed at the supraumbilical level and the two working ports were inserted at the lateral border of the rectus in the midclavicular line. The port on the side of the hernia was placed at the level of the umbilicus whereas the contralateral port was placed about two centimeters below the level of the umbilicus. After insufflation and visualization of the inguinal region, dissection was done to create a preperitoneal space on the side of the hernia by dividing the peritoneum. This was followed by dissection of the sac and parietalization of cord contents (vas-deferens and testicular vessels). A polypropylene mesh of 12-15 cm was used to place and cover all the potential hernial defects in the groin region.

Surgery was performed in the Lichtenstein group with a transverse incision 1.25 cm above the inguinal ligament extending from deep to the superficial ring. Identification and separation of the sac from the cord contents were followed. A mesh of size 6-11 cm was fixed with a monofilament polypropylene 3/0 suture. The lower end of the mesh was sutured to the inguinal ligament and the upper end to the conjoint tendon. The analgesia in the form of intramuscular Diclofenac sodium (75 mg) was administered immediately following surgery and was repeated after 6 hours. The duration of the operation was noted in minutes from the start of the incision till the completion of each procedure.

A visual analog scale (VAS) was used to measure the patient's pain at 8 and 24 hours after surgery. The complications like seroma, hematoma formation, and infections were noted. The hospital stay of the patients was recorded in hours. The patients were followed-up after 3 months for recurrence.

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences (SPSS) version 24 was used for data assessment. For all the quantitative data, the mean and standard deviation were determined. Frequency and percentage were calculated for wound complications and recurrence. An independent t-test was used to compare study outcomes in both groups. A p-value ≤0.05 was considered significant.

RESULTS

The mean age of patients in the TAPP and Lichtenstein groups were 31.90±18.18 years and 33.40±15.04 years, respectively. Patients in this study ranged in age from 21 to 60 years. The majority of patients in this study had right-sided hernias 55(62.5%) and indirect hernias 71(80.68%). The mean operative time in the TAPP group was prolonged (76.4±13.1 min) as compared to the Lichtenstein group (56.4±11.3 min). The postoperative pain score at 8 hours in the TAPP group was 3.21±1.23 and in the Lichtenstein group was 4.84±1.41. Similarly, the pain score after 24 hours of operation in the TAPP group was 2.34±0.94 and in the Lichtenstein group was 3.02±0.95 (Figure 1). The duration of hospital stay for the TAPP group and Lichtenstein group was 22.6±5.7 hours and 35.8±10.9 hours, respectively (Table 1). The occurrence of complications like seroma formation and infection in both groups are depicted in Table 2. There was no reported case of recurrence in both group during the three months follow-up period.

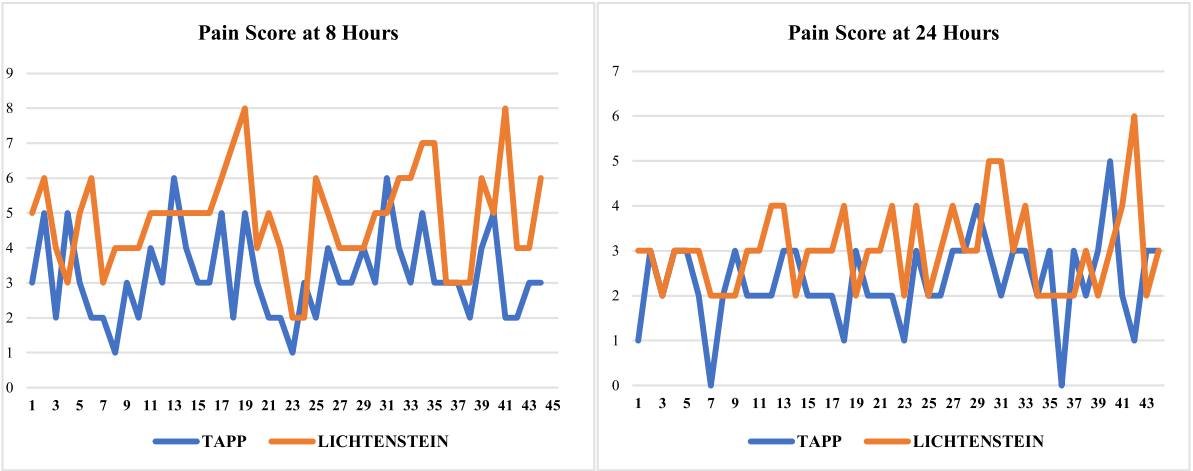

Figure 1: Comparison of Pain Score in Study Groups

Table 1: Comparison of Outcome between TAPP and Lichtenstein's Repair

Study Variables	TAPP Repair	Lichtenstein Repair	p-value
Mean Operative Time (min)	76.4±13.1	56.4±11.3	<0.001*
Pain Score at 08 Hours	3.21±1.23	4.84±1.41	<0.0001*
Pain Score at 24 Hours	2.34±0.94	3.02±0.95	0.001*
Mean Hospital Stay (Hours)	22.6±5.7	35.8±10.9	<0.001*

**Significant p-value*

Table 2: Comparison of Complications between TAPP and Lichtenstein Group

Complications	TAPP Frequency & Percentage	Lichtenstein Frequency & Percentage
Wound Infection	1(1.14%)	4(4.55%)
Seroma Formation	10(11.35%)	6(6.81%)
Recurrence	Nil	Nil

DISCUSSION

Inguinal hernia repair has traditionally been done by open techniques for decades with or without the placement of mesh.[9] Lichtenstein mesh hernioplasty is an open method for inguinal hernia repair with varied results.[10] Laparoscopic procedures are being used by general surgeons as an alternative to open surgery since the development of minimally invasive surgery. This minimally invasive approach has the potential to become a gold standard with the development of more skills and expertise.[11]

According to our findings, the mean operating time in the TAPP group (76.4±13.1 min) was longer than in the Lichtenstein group (56.4±11.3 min). Postoperative pain score at 8 and 24 hours was less in the TAPP group as compared to the Lichtenstein group. The duration of hospital stay for the TAPP group was less as compared to Lichtenstein group (p-value <0.001).

The majority of wound infections [4(4.55%)] occurred in the Lichtenstein group. However, the incidence of seroma formation with scrotal edema was slightly higher in the TAPP group [10(11.35%)]. The same findings were observed in another study conducted by Salma et al.[12]

Another study was conducted in a tertiary care hospital to compare open & laparoscopic hernia mesh repair. Fifty inguinal hernia patients were included. The study found that 1 patient who underwent laparoscopic surgery and 4 individuals who underwent open hernioplasty experienced wound infection. In 2 cases of open hernioplasty, seroma, and hematoma were present at the operated site; the same complications were not seen in the laparoscopic repair group. Inpatient stays for open hernioplasty and laparoscopic hernia were 3.23 days and 3.5 days, respectively. Laparoscopic surgery took 84.25 minutes whereas open surgery took 71.5 minutes. They concluded that patients who underwent laparoscopic surgery had less postoperative problems.[13]

A study compared unilateral laparoscopic inguinal hernia surgery with Lichtenstein tension-free mesh repair. Sixty patients were included; 30 got laparoscopic inguinal hernia treatment, while the remaining 30 underwent open inguinal hernia repair. Postoperative pain, hospital stays, and times for returning to work were noted in both groups. Patients who underwent open surgery were 46.73 years old, whereas those who underwent laparoscopic surgery were 42.10 years old. In the open hernioplasty group, 23.3% of patients developed seroma & hematoma in the postoperative period, whereas in the laparoscopic group, 10% had seroma collection. Both groups did not experience recurrence. In the early postoperative phase, there was no significant difference in pain score. The pain score was significantly decreased in the laparoscopic group at the third and seventh postoperative days. Inpatient stays averaged 7.8 days for open hernia repairs and 3.07 days for laparoscopic repairs. The average time it took to return to work after an open hernioplasty was 14.37 days, while it took 9.13 days after a laparoscopy. In comparison to Lichtenstein repair, the study found that laparoscopic inguinal hernia repair for unilateral inguinal hernias is a better procedure in terms of postoperative pain, hospital stay, and return to work.[14]

Another study compared the postoperative consequences of unilateral inguinal hernia repair using laparoscopic TAPP repair and Lichtenstein mesh

repair. Patients with unilateral inguinal hernias and ASA grades I/II were randomly assigned to two groups. Patients in group I underwent Lichtenstein open mesh repair, whereas those in group II underwent laparoscopic TAPP surgery. According to the study, individuals who had TAPP repair experienced less postoperative pain than those who had Lichtenstein mesh repair. Postoperative complications were more in Lichtenstein open mesh repairing group. In comparison to Lichtenstein mesh surgery, they found that laparoscopic TAPP repair for inguinal hernias is associated with fewer postoperative pain, complications, and a shorter hospital stay.[15]

A randomized controlled trial was conducted at Quaid-e-Azam Medical College, Bahawalpur. Fifty patients over the age of 18 were included, 32 of them underwent Lichtenstein surgery and 18 underwent laparoscopic surgery. They found that the median age of the patients in Lichtenstein was 45.9 years, while in the laparoscopic group it was 44.95 years. In the Lichtenstein and laparoscopic groups, the operating time was 37.96±13.66 and 48.77±9.99 minutes, respectively. The hospital stay & recovery time in open surgery and laparoscopic groups was 2.28±0.79 days and 13.20±4.75 days, respectively. In laparoscopic group hospital stay was 1.55±0.63 days and the recovery time was 10.47±3.59 days. In the Lichtenstein group, the pain score was 6.1±1.9, while in the laparoscopic group, it was 5.2±0.94. Less postoperative discomfort, a shorter hospital stay, and an earlier return to work were all advantages of laparoscopic hernia repair over Lichtenstein repair.[16]

To compare the results of TAPP and Lichtenstein techniques, a systematic review and meta-analysis was conducted. Operation time, hospital stay, acute and chronic postoperative pain, and the amount of time needed to resume normal activity, as well as wound infections, hematomas, seromas, neuralgia, and recurrence were noted. Compared to TAPP, the Lichtenstein repair had less operative time. Patients who operated with the laparoscopic method showed less postoperative chronic pain. A comparison of other outcomes did not show any difference between the two methods. So, it was seen that less chronic postoperative pain is the only advantage of TAPP over the Lichtenstein operation.[17]

Another meta-analysis conducted by Aiolfi et al. showed that postoperative acute and chronic pain, return to work, wound infections, and the hematoma was significantly reduced in minimally invasive TAPP. No significant difference was found when hospital stay, seroma, and hernia recurrence were compared in both treatment groups.[18]

CONCLUSION

Transabdominal laparoscopic repair is associated with less pain and hospital stay. However, the complication rates of both procedures are comparable.

LIMITATIONS & RECOMMENDATIONS

Short follow-up period of 3 months and enrolment of patients with unilateral hernia are limitations of this study. Further, clinical trials on large scale with inclusion of bilateral are recommended to validate this approach.

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