



Evaluation of Concomitant Ligamentous Injuries of Knee Joint in Patients with Ipsilateral Femoral Shaft Fractures

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Abstract

It is estimated that the annual incidence of femoral shaft fracture is 9.9 fractures per 100,000 person-years. Concomitant knee injury is a common finding in femoral fractures but can be easily missed during early management of initial trauma. Degree of damage to articular structures varies considerably, from only a mild effusion to complete ligament and meniscal tears. In good number of cases, these injuries are likely to be overlooked or entirely missed. The present study aims at evaluating concomitant ligament injuries of knee joint in patients with ipsilateral femoral shaft fractures by clinical examination under anesthesia after fixation of femoral shaft fractures. Between September 2013 and September 2015, all patients who underwent osteosynthesis for diaphyseal femoral were evaluated by clinical examination under anaesthesia with the aim of assessing the incidence of ligament injuries. There was ACL injury in 18 patients (41%), MCL in 13 (29%), PCL in 7(16%), LCL in 6 (14%). This study showed an overall incidence of ligament injuries in 36.7 % with ipsilateral femoral fractures.

Keywords: Fractures, Femur, Knee, Ligaments.

Introduction

It is estimated that the annual incidence of femoral shaft fracture is 9.9 fractures per 100,000 person-years^[1]. Femoral fractures have two critical peaks of distribution: (1) young adults (from 15 to 34 years of age), and (2) elderly (over 70 years of age)^[2]. High energy trauma is the main cause of fractures in younger populations, whereas low energy trauma accounts for most of the cases in people aged 60 or older^[3].

Most fractures of shaft of the femur are caused by high - energy trauma. The considerable energy required to cause these fractures often damages

other structures as well. Concomitant knee injury is a common finding in femoral fractures but can be easily missed during early management of initial trauma. Degree of damage to articular structures varies considerably, from only a mild effusion to complete ligament and meniscal tears^[4]. Knee ligament injuries, historically called as the internal derangements of knee (IDK) are mostly not visible in plain radiographs taken in emergency and in good number of cases, these injuries are likely to be overlooked or entirely missed^[5]. Such associated knee injuries may potentially add to increased morbidity to the

patients, especially if they are unrecognized and untreated.

To diagnose ligament injuries within this association, several methods have been reported. Physical examination under anesthesia, arthroscopy, and knee radiographs under stress, and magnetic resonance imaging are the various methods to diagnose these injuries.

The present study aims at evaluating concomitant ligament injuries of knee joint in patients with ipsilateral femoral shaft fractures by clinical examination under anesthesia after fixation of femoral shaft fractures

Aims and Objectives

1. To evaluate the incidence of concomitant ligamentous injuries of knee joint in patients with ipsilateral femoral shaft fractures.
2. To review the available literature.

Material and Method

Between September 2013 and September 2015, all patients who underwent osteosynthesis for diaphyseal femoral were evaluated by clinical examination under anaesthesia with the aim of assessing the incidence of ligament injuries.

The routine examination was performed during the same induction of anaesthesia as for osteosynthesis on the femoral fracture. This did not generate any risks, discomfort or additional cost for the patient or the institution. In all cases, the clinical examination was conducted by more than one professional and was always confirmed by a professional with experience of knee surgery. After femoral fixation by any method, all patients underwent a thorough physical examination of involved knee by various tests i.e. ADT, PDT, Lachman test, varus and valgus stress test, Palpable fluid wave test and patellar tap test, Posterior sag sign etc.

The Anterior drawer test was performed with the patient lying supine. Hips were flexed; knees were flexed to 90 degree, with the feet placed flat on the table. The tibia was pulled forward on the

femur by placing hands around the tibia. When the tibia moved forward more than 6 mm on the femur, the test considered as positive.

The Lachman test was done with the patient lying supine; the patient's knee at 15 degree of flexion and an external rotation was performed, stabilizing the femur with one hand as the tibia moved forward. Presence of a mushy or soft endpoint when the tibia was moved forward on the femur was considered as positive.

Valgus and varus stress tests were performed while the patient was lying supine and the knee was in complete extension. The examiner placed one palm against the lateral aspect of the patient's knee at the joint line for valgus test and opposite for varus test.

In cases where knee has to be exposed for retrograde nailing, a direct examination of the involved knee joint was also performed.

No ligament injuries were treated at the time of diagnosis.

All patients signed a free and informed consent statement at the time of their own hospital admission or before the procedure.

Patient details and findings of examinations were noted on proforma.

The research project was approved by the research Ethics Committee.

Inclusion criteria

1. Traumatic femoral shaft fractures (open or closed) in patients between 18 to 60 year age groups.

Exclusion criteria

1. Femoral shaft fractures with intra articular extension.
2. Pathological femoral shaft fractures.
3. Previous ipsilateral knee joint abnormality.
4. Age less than 18 or more than 60 years.

Observation and Results

A total of 156 patients with femoral fractures were operated in our orthopaedics department between September 2013 to September 2015; however, since 25 patients didn't met the age criteria (15

were < 18 and 10 were > 60), 7 patients were having pathological fractures, 5 patients were known case of post polio residual paralysis (PPRP) and 35 patients were having intra-articular extension, Our sample comprised 84 patients with 87 knees with femoral shaft fractures, among which there were 32 patients (36.7%) with ipsilateral knee ligament injury.

72 were male (Right 37, Left 35 and 2 bilateral) and 12 female (Right 6, Left 6 and 1 bilateral)

The trauma mechanism was a road traffic accident in majority (85%) followed by assault (8%) and fall from height (7%).

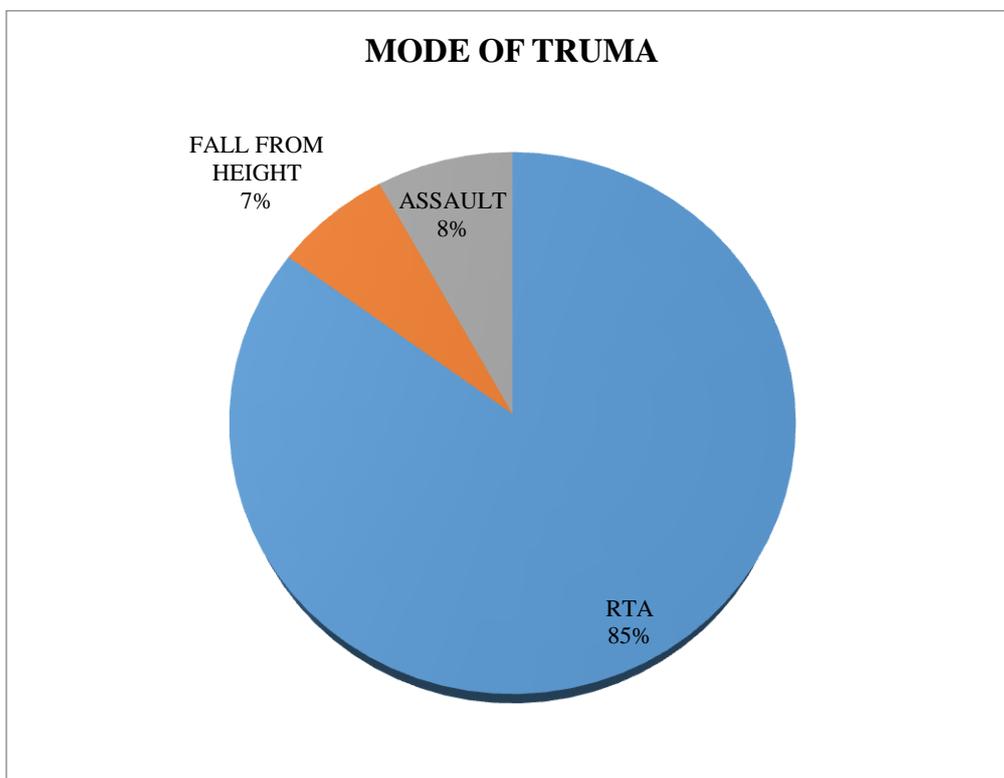
The patient's ages ranged from 18 to 60 years, with a mean age of 29.18 years.

Type of fixation was intramedullary nailing in 77 (88.5%) and plating in 10 (11.5%).

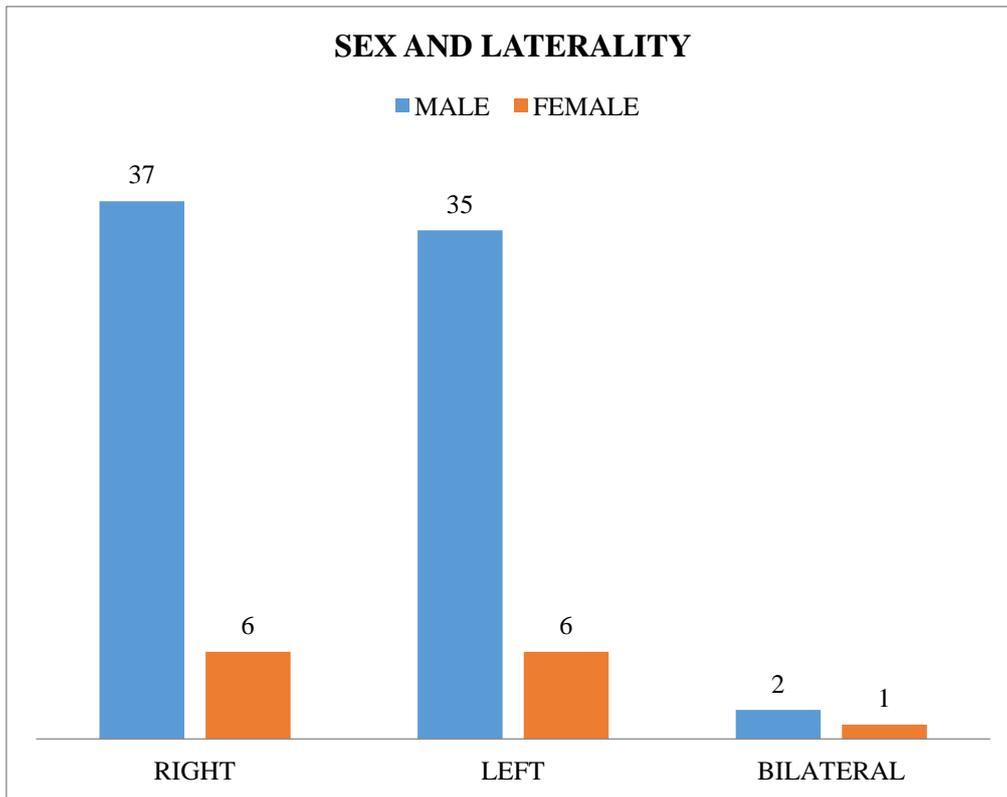
Most common isolated injury was ACL tear in 9 (28%) followed by MCL injury in 5 (16%), 4 PCL tear (13%), LCL injury in 2 (6%),

Most common combination pattern was ACL+MCL in 7 patients (22%) followed by ACL+LCL in two patient (6%), PCL+LCL in two patient (6%) and PCL+MCL in one patient (3%).

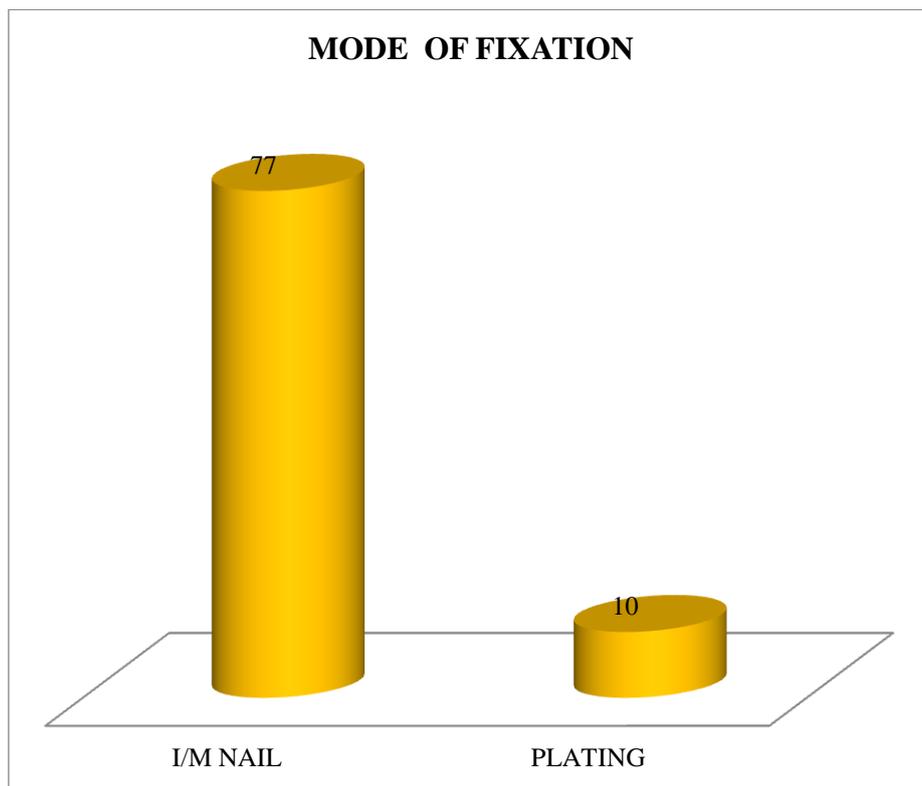
There is Overall incidence of ACL injury in 18 patients (41%), MCL in 13 (29%), PCL in 7 (16%), LCL in 6 (14%).



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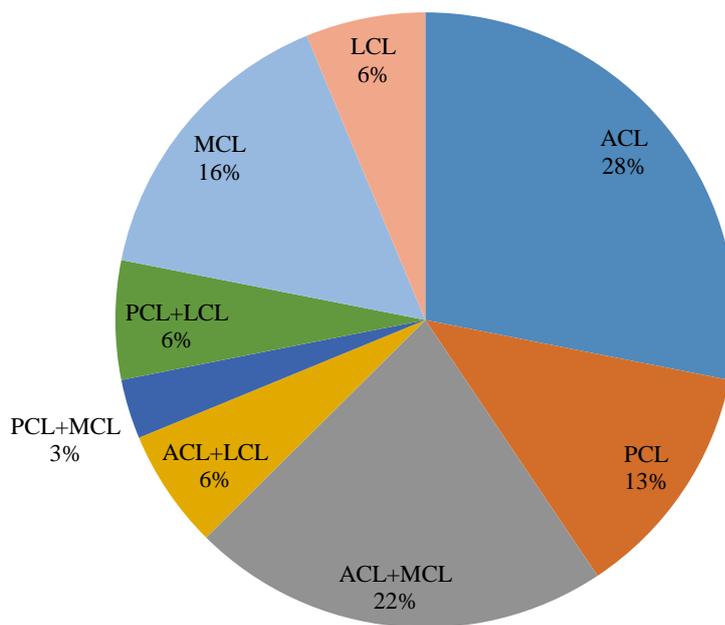


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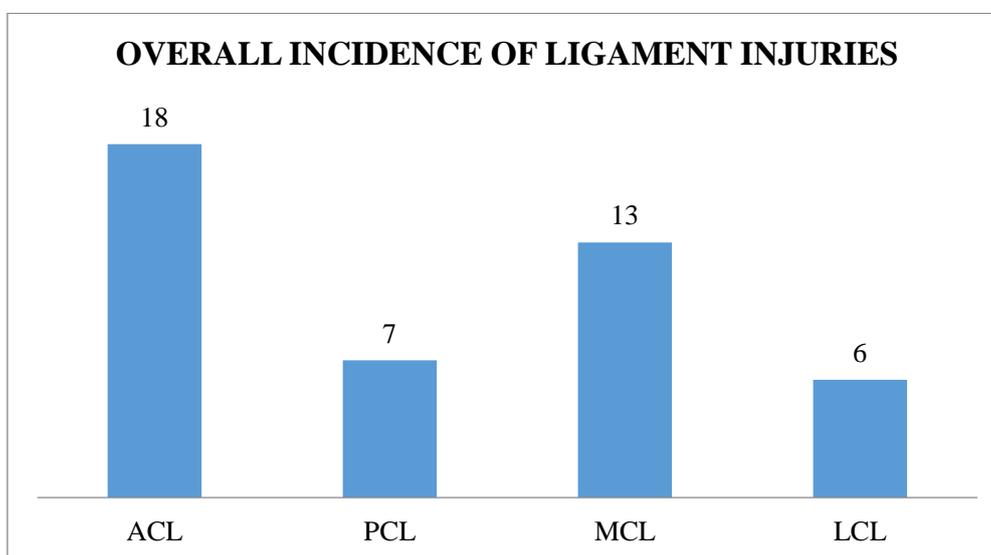
ISOLATED INJURY Vs COMBINATION PATTERN



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Most common combination pattern was ACL+MCL in 7 patients (22%) followed by ACL+LCL in two patient (6%), PCL+LCL in two patient (6%) and PCL+MCL in one patient (3%).

OVERALL INCIDENCE OF LIGAMENT INJURIES



There is Overall incidence of ACL injury in 18 patients (41%), MCL in 13 (29%), PCL in 7 (16%), LCL in 6 (14%).

Discussion

It is estimated that annual incidence of femoral shaft fracture is 9.9 fractures per 100,000 person years. The possibility of concomitant knee

ligamentous injury with high energy mechanism fractures of femur is well known to traumatologists.

Regarding the incidence of knee ligament injuries associated with femoral shaft fractures, some studies have performed physical examination under anaesthesia and shown results similar to us.

Taheriazam et al in 2008 studied a total of 125 patients with isolated femoral shaft fractures who underwent a thorough clinical examination of knee immediately after fixation and found incidence of 31.2% (39 patients) with simultaneous knee ligament injuries.

Marco Tulio Lopes Calasa et al in 2012 studied 36 patients with femoral shaft fractures. During the osteosynthesis procedure to repair the femur while under anesthesia, all patients underwent a physical examination. The most common mechanism of injury observed was motorcycle accidents. Of the thirty - six patients that were studied eleven patients (30.5%) had a knee ligament injury. Of the eleven patients, 64% had a cruciate ligament injury.

The characteristics of both of the studies are as follow:

	Total No. of patients	Method used	Overall incidence of ligament injuries
Our Study	84	Physical examination	(n=32) 36.7%
Taheriazam et al 2008	123	Physical examination	(n=39) 31.2%
Caldas et al 2012	36	Physical examination	(n=11), 35.5%

While we evaluated the patients by physical examination only, there are studies who added arthroscopy after clinical examination.

They emphasized that arthroscopy of knee is a common diagnostic procedure to find out and confirm IDK. It may even be considered by some as superior over MRI in its ability to probe, distinguish fragile tissue from normal, and perform additional surgical procedures. It is an extension of the surgeons own finger. Doing arthroscopy at the same sitting with internal fixation of fractures may be a cost and time effective option and may allow diagnosing and managing treatable conditions at the same sitting or plan for the next best investigation.

In a study published by Meybodi et al in 2013, 40 patients with fracture shaft femur were evaluated clinically and arthroscopically. Arthroscopy revealed medial meniscus injury in 12 (27%) knees. Three (7%) lateral meniscus injuries, 18 (40.9%) ACL injuries and 2 (4.5%) PCL injuries were also found. In varus and valgus stress tests 15 (34%) MCL and 4 (9%) LCL laxities were noticed. The Lachman test was positive in 3 (6%), and ADT was positive in 2 (4.5%) patients.

Brajesh Kumar et al (2012) studied 41 patients with femoral shaft fractures clinically and arthroscopically immediately after fixation and found an overall incidence of knee ligament injury in 14 patients (34%). ACL was the most common injury followed by MCL.

	Total No. of patients	Method used	Overall incidence of ligament injuries
Our Study	84	Physical examination	(n=32) 36.7%
Meybodi et al 2013	42	Physical examination and arthroscopy	(n=15) 35.7%
Kumar et al 2014	41	Same as above	(n=14), 34%

It is well known that in evaluating acute knee injuries, the gold standard is physical examination, sometimes done under anaesthesia, in association with magnetic resonance analysis. In our institution, MRI is difficult to obtain, which has made physical examination under anaesthesia fundamentally important for the diagnosis.

Adding arthroscopy may drastically enhance the results. It has been previously stated by different authors that it is difficult to identify partial ACL tear in a physical examination; additional assessment using MRI or arthroscopy is needed. This discrepancy further highlights the need for careful evaluation of affected knees in patients with femoral fractures, even in the face of an evidently normal physical examination, since the Lachman test has a limited ability in detecting partial tears.

Conclusion

This study showed an overall incidence of ligament injuries in 36.7 % with ipsilateral femoral fractures.

We conclude that there is high incidence of ipsilateral knee ligament injuries in patients with diaphyseal fracture shaft femur and one should have high index of suspicion in diagnosing these injuries.

We highlight the difficulty of diagnosis at the time of admission and need for systemic physical examination after surgical treatment of femoral fractures.

Physical examination performed just after fracture fixation, with the patient anaesthetized may help to explain the majority of diagnoses and enable early treatment, which would be more appropriate. It will avoid the cost of MRI and Arthroscopy and will be time effective also, as no need to expose the patient to another surgery.

Earlier will be the diagnosis, hence the management and reduced morbidity overall.

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References

1. Salminen ST, Pihlajamaäki HK, Avikainen VJ, Boöstman OM(2000) Population based epidemiologic and morphologic study of femoral shaft fractures. Clin Orthop Relat Res 372:241–249
2. Singer BR, McLauchlan GJ, Robinson CM, Christie J (1998) Epidemiology of fractures in 15,000 adults: the influence of age and gender. J Bone Joint Surg Br 80(2):243–248
3. Nieves J, Bilezikian J, Lane J, Einhorn T, Wang Y, Steinbuch M, Cosman F (2010) Fragility fractures of the hip and femur incidence and patient characteristics. Osteoporos Int 21(3):399–408
4. Emami Meybodi, Mohammad Kazem et al. "Concomitant Ligamentous and Meniscal Knee Injuries in Femoral Shaft Fracture." Journal of Orthopaedics and Traumatology: Official Journal of the Italian Society of Orthopaedics and Traumatology 15.1 (2014): 35-39. PMC. Web. 8 Nov. 2015
5. Kumar S, Bahadur R, Kumar V, Duhan S, Aggarwal P. Avulsion fracture of the tibial attachment of the posterior cruciate ligament in association with ipsilateral femoral shaft fracture -report of three cases. Indian J Orthop 2003;37:271-3
6. Ritchey, S.J.; Schonholtz, G.J.; and Thompson, M.S.: The Dashboard Femoral Fracture Pathomechanics, Treatment and Prevention. J. Bone and Joint Surg., 40A:1347, 1958.
7. Omer, G.E.; Moll, J. H.; and Bacon, WL: Combined Fractures of the Femur and Tibia in A Single Extremity. Analytic Study of Cases at Brooke General Hospital from 1961-1967. J. Trauma, 8:1026, 1968.
8. Pedersen HE, Serra JB (1968) Injury to the collateral ligaments of the knee associated with femoral shaft fractures. Clin Orthop Relat Res 60:119-121.
9. Walker DM, Kennedy JC (1980) Occult knee ligament injuries associated with femoral shaft fractures. Am JSports Med 8(3):172-174
10. De Coster TA, Teter KE. Knee Ligament Injuries Ipsilateral to Femoral Shaft Fractures. The Iowa Orthopaedic Journal. 1989;9:98-99.
11. Walling AK, Seradge H, Spiegel PG (1982) Injuries to the knee ligaments with fractures of the femur. J Bone Joint Surg Am 64(9):1324-13
12. Moore TM, Patzakis MJ, Harvey JP Jr (1988) Ipsilateral diaphyseal femur fractures and knee ligament injuries. Clin Orthop Relat Res 232:182-18
13. Szalay MJ, Hosking OR, Annear P (1990) Injury of knee ligament associated with ipsilateral femoral shaft fractures and with ipsilateral femoral and tibial shaft fractures. Injury 21(6):398-400

14. Vangsness C, Jr, DeCampos J, Merritt P, Wiss D (1993) Meniscal injury associated with femoral shaft fractures. An arthroscopic evaluation of incidence. *J Bone Joint Surg Br* 75-13(2):207-209.
15. Buckley, Steven L. M.D.; Sturm, Peter F. M.D.*; Tosi, Laura L. M.D.*; Thomas, Michael D. M.D.*; Robertson, William W. Jr. M.D.**Journal of Pediatric Orthopaedics: March/April 1996 - Volume 16 – Issue 2 - pp 206-209.*
16. Faccini R, Sartori E, Biscione R, Lupi L. Association between fracture of the diaphysis of the femur and lesion of the ligaments of the knee. *Chir Organi Mov.* 1993;78:177-82
17. De Campos J, Vangsness CT Jr, Merritt PO, Sher J (1994) Ipsilateral knee injury with femoral fracture. Examination under anesthesia and arthroscopic evaluation. *ClinOrthopRelat Res* 300:178-182
18. Blacksin MF, Zurlo JV, Levy AS (1998) Internal derangement of the knee after ipsilateral femoral shaft fracture: MR imaging findings. *Skeletal Radiol* 27 (8):434-439
19. Dickson KF1, Galland MW, Barrack RL, Neitzschman HR, Harris MB, Myers L, Vrahas MS Magnetic resonance imaging of the knee after ipsilateral femur fracture. *J Orthop Trauma.* 2002 Sep;16(8):567-71.
20. Taheriazam A, Tahmasebi M. Knee Ligament Injury in Femoral Shaft Fractures. *ZJRMS.* 2008; 10 (4) :0-0
21. David W. Sanders, MD, MSc; Mark MacLeod, MD; Tanya Charyk-Stewart, BSc, MSc; Jeannette Lydestad, RN; Andrea Domonkos, BSc; Christina Tieszer, BSc, MSc Functional outcome and persistent disability after isolated fracture of the femur *J can chir, Vol. 51, No 5, octobre 2008*
22. Auffarth A, Bogner R, Koller H, Tauber M, Mayer M, Resch H, Lederer S (2009) How severe are initially undetected injuries to the knee accompanying a femoral shaft fracture? *J Trauma* 66(5):1398-1401
23. CALDAS, Marco Tulio Lopes et al. Injury of the knee ligaments associated with ipsilateral femoral shaft fractures. *Rev. bras. ortop.* [online]. 2013, vol.48, n.5 [cited 2015-11-08], pp. -----438-440
24. Kumar, Brajesh et al. "Risks of Concomitant Trauma to the Knee in Lower Limb Long Bone Shaft Fractures: A Retrospective Analysis from a Prospective Study Population." *Advanced Biomedical Research* 3 (2014):49. PMC. Web. 8 Nov. 2015.
25. Rodriguez-Merchan EC, Moraleda L, Gomez-Cardero P. Injuries Associated with Femoral Shaft Fractures with Special Emphasis on Occult Injuries. *Archives of Bone and Joint Surgery.* 2013;1(2):59-63.
26. Rahim Ebrahimi, Naser Janmohammadi, Mokhtar Esmaeil Nejhad Ganji and Masoud Bahrami Prevalence of Hip and Knee Injuries Combined with Ipsilateral Femoral Shaft Fractures, Shahid Beheshti Hospital, Babol Middle-East Journal of Scientific Research 23 (8): 1862-1867, 2015 ISSN 1990-9233 CD IDOSI Publications, 2015 DOI: 10.5829/idosi.mejsr.2015.23.08.264.