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Pseudarthrosis Formation in Open Fractures of Long Bones

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Abstract: ***Introduction: Pseudarthrosis formation in open fractures of long bones is one of the main problems of open fractures' treatment. While twofold time for healing of a fracture lasts and the fracture does not heal its seems pseudarthrosis formation occurred in the affected area[12]. The main cause and predisposition factors of pseudarthrosis are infections, non-supportive fixation, bone and soft tissues defect, late reposition, cutting of artery, heavy skin scars, multiple fractures, temporary fixation and so on. In 3 to 6 percent of long bones fractures behind trauma the pseudarthrosis are formed. According to experience of Second World War 3% of pseudarthrosis are reported in open fractures. The process of pseudarthrosis formation is complicated and its treatment in presence of current traumatology development is difficult and has need for more investigations. Aim: Find prevalence of pseudarthrosis predisposing factors in open fractures of long bones. Method: This was a cross sectional study among 32 patients from 450 hospitalized orthopedic patients in Ali-abad teaching hospital during the year 1395. This research has been done by using patients' files, X-ray and their operations' protocol. All data collected in research forms and the help of SPSS and Excel programs has done analysis. Results: On 450 orthopedic patients among 32 cases with pseudarthrosis of open fractures of long bones which has been referred or hospitalized in Ali-abad teaching hospital during 1395 and operated, most of them (16 patients 50%) were in their fifth and sixth decades of life. 20 cases 62.5% were males and rest of them 12 cases 37.5% were females. In this research 12 cases 40.62% had pseudarthrosis in Tibia, 9 cases 28.12% had humerus bone pseudarthrosis while 7 cases 21.87% of patients had femoral bone pseudarthrosis. According to predisposing factors 10 cases 31.16% had non-supportive fixation, 6 cases 18.75% had infection, 5 cases 15.62% had defect of bone and soft tissues and 4 cases 12.5% had multiple fractures. Conclusion: Prevalence of pseudarthrosis in open fractures of long bones according to etiologic factors in first degree was non-supportive fixation, in second degree infection, in third degree defect of bone and soft tissues and lastly was multiple fractures. According to location in first degree tibia, second degree humerus and third degree femoral bones had pseudarthrosis.***

Keywords: Pseudarthrosis, Non-union, Osteogenic, Long Bone Fracture

1. Introduction

0ne of the main problems of treating open fractures of long bones is the formation of pseudo arthrosis. *Pseudo arthrosis forms when fracture does not heal after it takes two times the average period for a fracture to heal.* Pseudo arthrosis is described as formation of sclerosis at fractured ends, formation of fibrotic tissue in synovial membrane and synovial fluid which can be noticed by X-ray during surgery procedures. Different factors like infections, non-rigid fixation, bone and soft tissue defects, late reposition, nerve and artery cut, large skin scars, multiple fractures, short-term fixation and others are involved in the formation of pseudo arthrosis.[1] Treatment of pseudo arthrosis is still a problem for doctors amid the advances in the knowledge of modern orthopedics and traumatology.[2]

The incidence of pseudo arthrosis is generally 3 – 16% in open fractures of long bones following trauma. Based on the experience of Second World War, the incidence of pseudo arthrosis was reported 3% following () open fractures of long bones. Although the treatment of aseptic pseudo arthrosis is complicated following compound open fractures, the treatment of infected pseudo arthrosis is even a lot more complicated and serious.[3] All the scientists and researchers around the world, especially those of the former USSR have contributed a lot in finding a solution to the problem. They have proposed different treatment options for pseudo arthrosis like decortication, transplant fixation & fixation of fractured segments using intra medullary osteosynthesis.[4]

Some other scientists like Begdanov and Muhammad Musa Wardak have proposed the method of extra medullary osteosynthesis for a better rigid fixation using homo and hetero plasty in order to provoke the process of regeneration. All these methods have both positive and negative aspects. As a result, more and more research is needed to be done regarding the procedure and ways to effectively treat the patients. [5]

Research Aim: to find out the prevalence of predisposing factors for pseudo arthrosis among patients hospitalized for open fractures at orthopedic department of Ali Abad Teaching Hospital from February 2016 to March 2017.

Research Questions:

1) What is the prevalence rate of risk factors for pseudo arthrosis in open fractures of long bones according to infections, non-rigid fixation, bone and soft tissue defects, late reposition, artery and nerve cut, large skin scars, multiple fractures, short-term fixation?

2) Which segment of the long bones is affected the most?

2. Background

Pseudo arthrosis is one of the main complications of fractures, especially open fractures of long bones. The process of its formation is complicated involving different risk factors of which infection is the most important. The control of infection along with the treatment of pseudo arthrosis gets more complicated and needs more research. Although many researchers have been done about the prevalence of pseudo arthrosis and its predisposing factors.[6]

G.M. Calori, W. Albisetti, A. Agus, S. Lori and L. Tagliabu defined pseudo arthrosis as 'Pseudoarthrosis occurs when consolidation cannot be completed without new biological or mechanical stimulation" in a research carried out in the University of Milan in 2007.[7]

Then different scientists proposed the theory of osteogenic mechanism in non-union involving general risk factors like age, gender, diet, osteoporosis, muscle mass, smoking, alcohol, Analgesics like Aspirin and local factors like number of fractured parts, fracture type, infection, uncovered bone and multiple traumas.[8]

According to the statistics from 2k-Basharova- 1971, out of 226 incidence of pseudo arthrosis of tibial bone following open fractures, 81.4% of them had wound infection in their histories and 70% of them were suffering from osteomyelitis. According to a research by Lucynara, Macros and Almeida from Germany in 2009, infected pseudoarthrosis accounted for 26 cases (83.9%) and non-infected pseudoarthrosis accounted for 76 cases (83.5%) among male patients. In the upper extremity, infected pseudoarthrosis accounted for 9 cases (29%) and non-infected account for 35 cases (38.5%) while in the lower extremity, infected cases were 22 (71%) and non-infected cases were 56 (61.5%).[9]

In a research carried out by French Writers M. Tall and D. Bonkoungou and others in 27 July 2014 on 50 cases of pseudoarthrosis, there were 38 males and 12 females with an average age of 40 years (ranging between 17 & 60). Pseudoarthrosis were formed 11 months after the fracture in the following bones; Femur (14%), tibia (22%), Humerus (8%) and forearm (6%).[11]

According to the experience of World War two, 3% pseudoarthrosis was reported following open fractures. In a research carried out in the main Army Hospital from 1977 to 1988 by Prof. Dr. Muhammad Musa Wardak & Dr. SaifurRahman on 470 patients suffering from pseudoarthrosis, the cases were mostly from the segments of shin. In the research, the incidence of non-infected pseudoarthrosis was 208 cases (44.29%) while the incidence of infected pseudoarthrosis was 262 cases (55.74%). Non-rigid fixation was the leading cause of pseudoarthrosis followed by infection as the second most common cause which accounted for (27.79%) in the research.[12]

3. Method

This was a cross-sectional observational study carried out on 32 patients out of 450 hospitalized patients who were suffering from pseudoarthrosis because of open fractures of long bones from February 2016 to march 2017. Information was gathered using forms from the files of the hospitalized patients, operation protocols and X-rays. Computer programs like (Excel and SPSS) were used to analyze the data and were presented as charts and graphs.

Inclusion Criteria
(Hospitalized patients who developed pseudoarthrosis after open fractures of long bones diagnosed using clinical and radiological signs and who underwent operations were included in the research.

Exclusion criteria
- Patients having a defective file
- Patients having closed fracture
- Patients under age of 18 were all excluded from the research.

Ethical Issues
While gathering information from the patients' files, the data was not disclosed if the information was secret.

Limitations: no limitations were noticed while gathering the information.

4. Results

The study was done on 32 patients suffering from pseudoarthrosis of open fractures of long bones from February 2016 to March 2017. It briefly discusses the results of pseudoarthrosis in open fractures of long bones seen in upper and lower extremities. The charts below discuss the results.

Chart (1): It shows the prevalence of pseudoarthrosis seen in open fractures of long bones according to age and gender.

Year	Age		Gender			
	No	%	Male		Female	
2nd Decade	5	9.37%	2	6.25%	1	3.12%
3rd Decade	5	15.62%	3	9.37%	2	6.25%
4th Decade	7	21.87%	4	12.5%	3	9.37%
5th decade	8	25%	4	12.75%	4	12.5%
6th decade	8	25%	6	18.75%	2	6.15%
7th Decade	1	3.12%	1	3.125%	0	0
Total	32	99.9%	20	62.74%	12	37.39%

It can be indicated from the chart (1) that majority of patients were in their 5th and 6th decades of life (50%) out of which male patients accounted for 20 cases (62.74%) and female patients accounted for 12 cases (37.39%).

Chart (2) shows the prevalence of risk factors for the formation of pseudoarthrosis in open fractures of long bones.

Year	February 2016 – March 2017	
Risk Factors	NO	%
Infection	6	18.75%
Non-rigid fixation	10	31.25%
Bone and soft tissue defect	5	15.62%
Late reposition	2	6.25%
Artery and nerve cut	0	0
Wide skin scar	2	6.25%
Number of fractures	4	12.5%
Short-term fixation	3	9.37%
Total	32	99.94%

It can be concluded from Chart (2) that the main reasons for the formation of pseudoarthrosis are: to the first degree, non-rigid fixation with 10 cases (31.25%), to the second degree, infection with 6 cases (18.75%), to the third degree, bone and soft tissue defect with 5 cases (15.62%), to the 4th degree, multiple fractures with 4 cases (12.5%), to the 5th degree, short-term fixation with 3 cases (9.37%) and finally late reposition held the last position with 2 cases (6.25%).

Chart (3) Shows the prevalence of the formation of pseudoarthrosis in open fractures according to location.

Year	February 2016 – March 2017	
Location of Pseudoarthrosis	Number	Percentage %
Femur	7	21.87%
Humerus	9	28.12%
Leg	13	40.62%
Forearm	3	9.37%
Total	32	100%

It can be concluded from chart (3) that the prevalence of pseudoarthrosis is seen mostly in leg bones 13 cases (40.62%). In the second position is the Humerus bone with 9 cases (28.12%) then Femoral bone with 7 cases and (21, 87%) and forearm bones held the last position with 3 cases (9.37%).

5. Conclusion

It can be concluded from the study of 32 cases of the prevalence of pseudoarthrosis in open fractures of long bones that most of the patients suffering from pseudoarthrosis were in there 5th and 6th decades of life with 16 cases (50%), then 4th decade of life with 7 cases (21.875%). Most of the patients were males with 20 cases (62.5%) and then the females with 12 cases (37.5%).

According to the prevalence of pseudoarthrosis in the research, leg bones held the first position with 13 cases (40.62%), humerus bone held the second position with 9 cases (28.12%) and femoral bone held the third position with 7 cases (21.87%).

According to the prevalence of risk factors of Pseudoarthrosis in open fractures of long bones, to the first position was non-rigid fixation with 10 cases (31.16%), to the second position was infection with 6 cases (18.75%), to the third position was defects of bone and soft tissue with 5 cases (15.62%) and to the fourth position was multiple fractures with 4 cases (12.5%).

6. Discussion

It was a cross-sectional study carried out on 32 patients having pseudoarthrosis of open fractures of long bones out of 450 hospitalized patients at Orthopedics Department of Ali Abad Teaching Hospital from February 2016 to March 2017.[13]

In this study, most of the patients having pseudoarthrosis of long bones were in their 5th and 6th decades of lives that is 16 patients and accounts for 50% of cases. According to a research by W. Albisetti, A. Agus in the year 2009, incidence of pseudoarthrosis was mostly noticed above 55 years of age, therefore; our results are the same as the international literature in terms of age. According to gender, most of the patients were male patients with 20 cases (62.5%) which was quite similar to a research done by M.Tall and D. Bonkoungou on 50 pseudoarthrosis patients in which 38 cases (76%) were male patients. Pseudoarthrosis of leg bones held the first position in our research similar to the results of the researches carried out by Prof Muhammad Musa Wardak and Dr. SaifurRahman at National Academic Hospital carried out on 470 patients from 1977 – 1988. The research carried out on 226 cases of pseudoarthrosis by ZK-Basharova showed most of the cases of pseudoarthrosis occurred in segments of leg bones.

In a research by M.Tall & D.Bonkoungou on 50 cases of pseudoarthrosis, Tibia (22%) and Femur (14%) accounted for most of the cases, which is similar to our research. In this research, most of the cases were caused by non-rigid fixation with 10 cases (31.25%) followed by infection with 6 cases (18.75%) which is quite similar to the results of Dr. SaifurRahman which showed (27.12%).[14]

7. Final Result

According to the etiologic factors the prevalence rate of pseudoarthrosis in open fractures of long bones is as follow; to the first degree non-rigid fixation, to the second degree infection, to the third degree bone and soft tissue defects and to the fourth degree multiple fractures and to the last degree other factors are involved.

According to the localization, Tibia held the first position, Humerus held the second position, Femur held the third position. In this research, pseudoarthrosis was seen mostly among male patients then female patients during the 5th and 6th decades of lives.

8. Suggestions

1) It is suggested from all doctors that if they face an open fracture, the injured limb should be ….. and transport fixated before delivering the patient to the hospital in order to prevent the entry of infection and soft tissue damage. After the patient is delivered to the hospital and hospitalized, the injuries should be cleaned carefully and a stable fixation of the fractures should take place. Because infection, artery and nerve damage and non-rigid fixation are the risk factors involved in the formation of pseudoarthrosis.

2) All the doctors are suggested to not remove the fixation of the fractures area before the fracture heals since removal of the fixation before the appropriate moment is a cause for pseudoarthrosis.
3) The treatment and care for the pseudoarthrosis is complicated and need thorough studies because the formation of pseudoarthrosis is a complex process

References

[1] Ashford Ru, Mehto JA, et all. (2004): Management of Tibial Fracture, 35:pp(411 – 416).
[2] B. Harandi Aalami et all. (2010): Textbook of Orthopedic Fractures, ed 4 pp(63).
[3] Cleveland KB. (2006): Infection General Principle ed 10 pp (643 – 659).
[4] G.M. Calori, W. Albisetti, A. Agus, S. Lori, L. Tagliabue. (2007): Risk factors contributing to fracture non-unions. pp(385, 511 – 518).
[5] Gastilo R, Mendonza R, William D. (1984): Problems in the Management of Type 3 Open Fracture, 24: pp(742 – 746).
[6] Harley BJ, Beaupre LA, Jones CA, et all. (2002): Treatment on the rate of Non-union and Infection Open Fracture, 16: pp(484 – 490).
[7] In the Septic Osteoarticular Pathology, unit (up. S. O. A) in the Orthopedic Series of the Coimbra University Hospital (H.U.C), https://link.springer.com .
[8] Kindsfater K, Jonassen EA. (1995): Osteomyelitis of the Tibia Open Fracture, pp(121 – 127).
[9] Leighton, R.; Watson, J.T; Giannoudis, P.; Papakostidis, C.; Harrison, A.; Steen, R.G. (May 2017): "Healing of fracture nonunions treated with low-intensity pulsed ultrasound (LIPUS): A systematic review and meta-analysis". Injury (7): 1339–1347.
[10] Ludbrook J. (2002): Statistical Techniques Methods of Measurement Critical Review, 29: pp(527 – 536).
[11] Muller SS, et all. (2003): Epidemiological Clinical Prospective Study of Long-Bone Pseuarthrosis, 11: pp(158 – 164).
[12] Niedzielski K, Synder M. (2000): "The treatment of pseudarthrosis using the Ilizarov method". Ortop Traumatol Rehabil. 2 (3): 46–8.
[13] Ostern HJ, Tscherne H. (1984): Pathophysiology of Soft tissue Injury with Fracture, pp(1 – 8).
[14] Wardak, M. Mussa, Saifurahman. (1987): Mine trauma, pp(84 – 95).