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Are we prepared for orthopedic trauma surgery outside normal working hours? A retrospective analysis

Normal çalışma saatleri dışında ortopedik travma cerrahisi için hazır mıyız? Retrospektif bir analiz

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BACKGROUND
This retrospective analysis was done to determine whether there is a change in outcomes of trauma patients undergoing intramedullary nailing (IMN) for femur and tibia fracture as an emergency versus elective procedure.

METHODS
Data were collected for all patients admitted to male orthopedic wards between 1 January 2004 and 30 June 2009 with femur and tibia fractures that required IMN. The data collected included surgery undertaken on as emergency or elective procedure, duration of surgery, complications encountered, and union status of fracture.

RESULTS
There were 431 fractures of the tibia, fibula and femur. Operating time for femur fracture as an emergency procedure was significantly greater than for elective surgery (191±79 versus 155±65 minutes; p≤0.001, confidence interval [CI] -19.54). For tibia fracture, operating times were 167.1±62 versus 69.2±35 minutes (p<0.001, CI <-85.4). Complications of infection, secondary surgery and of union were more common in emergency procedures than elective surgeries.

CONCLUSION
This study shows that complications are higher in emergency surgery than elective surgery due to the increase in the duration of surgery. This is attributed to the non-availability of dedicated trained orthopedic nursing staff and theater during emergency procedures. We believe that it is time to develop dedicated orthopedic trauma theaters in hospitals that treat emergency fracture fixations.

Key Words: Emergency care; elective surgery; fractures; trauma.

AMAÇ
Bu geriye dönük çalışma, femur ve tibia kırığına bağlı intramedüller çivileme (İMÇ) işlemi geçiren hastalarda elektif prosedüre karşı acil girişim sonuçlarında bir değişiklik olup olmadığını belirlemek amacıyla yapıldı.

GEREÇ VE YÖNTEM
Tüm veriler, 1 Ocak 2004 ile 30 Haziran 2009 tarihleri arasında İMÇ gerektiren femur ve tibia kırığı olan erkek hastaların kaldığı ortopedi yatakhanelerinden toplandı. Toplanan veri, acil veya elektif prosedür şeklinde gerçekleştirilen cerrahiyi, cerrahinin süresini, karşılaşılan komplikasyonları ve kırığın kaynama durumunu içerdi.

BULGULAR
Tibia, fibula ve femur 431 kırık vardı. Femur kırığı ile ilgili ameliyat süresi, acil bir prosedür şeklinde gerçekleştirilmesi durumunda elektif prosedür olarak gerçekleştirilme durumuna göre anlamlı şekilde daha uzundu (191±79 ve 155±65 dk; p≤0.001, güven aralığı [GA] -19.54). Tibia kırığında ameliyat süresi 167.1±62 ve 69.2±35 dk bulundu (p<0.001, GA <-85.4). Enfeksiyon, ikincil cerrahi ve kaynama komplikasyonları, elektif cerrahiye göre acil prosedürlerde daha yaygındı.

SONUÇ
Cerrahi süresindeki artış nedeniyle acil cerrahide komplikasyonlar elektif cerrahiye göre daha yüksek bulunmuştur. Bu durum, acil prosedürler sırasında özel eğitimli ortopedik hasta bakım personeli ve ameliyathanenin bulunmamasına bağlanabilir. Hastanelerde acil kırık tespitleri ve tedavisi icin özel ortopedi travma alanları oluşturulması gerektiğine inanmaktayız.

Anahtar Sözcükler: Acil bakım; elektif cerrahi; kırıklar; travma.

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Trauma is the major cause of morbidity and mortality in the world and is a major cause of economic burden. In the United States in 2000 alone, the 50 million injuries required treatment costing $406 billion, and males accounted for approximately 70% ($283 billion) of the total costs of injuries.[1] During the same year in the United Kingdom, the cost of hip fractures alone were reported at an estimated £726 million.[2] The basic epidemiological data on the incidence of fractures due to trauma and their distribution in the population in Saudi Arabia is non-existent,[3] even though studies of road traffic accidents in the country are well-reported.[4-8]

The immediate and definitive operative care of all fractures represents the optimal treatment for the patient, and this early total approach has been shown to be beneficial in comparison to elective surgery.[9-11] Challenges that are unique to the orthopedic specialty are the availability of an operating room to perform trauma surgery, and secondly, of specialized orthopedic nursing staff outside normal working hours, which improves productivity and the satisfaction of orthopedic surgeons as well as the patient outcomes.[12]

At our institution, a tertiary care trauma center, a dedicated orthopedic and trauma operating room and trained staff are not available outside normal working hours. Hence, fractures lose priority over blunt abdominal trauma, head injury and obstetrical emergencies. Orthopedic cases are done at the end of the day or at odd hours at night or even weekends with inexperienced supporting staff. Fortunately, only a small percentage of these injuries constitute surgical emergencies (compound fracture, pelvic injuries, fractures with neurovascular compromise, etc.). The majority of the cases fall under the subgroup "urgent" rather than "emergent", which should be done within 24 hours, but not necessarily at midnight.[13] Various studies undertaken recently showed that night-time surgeries increase various complication rates. Realizing these ominous challenges, new trends have been emerging recently to develop a dedicated orthopedic trauma staff and theaters.

The purpose of this study was to compare complications of intramedullary nailing (IMN) done for fractures of the femur and tibia as an emergency (without dedicated orthopedic operating room and trained orthopedic staff) versus elective procedure. We hypothesized that surgeries performed without significant back-up from paramedical trained staff result in increased mortality and morbidity.

MATERIALS AND METHODS

After obtaining approval from the Ethical and Research Committee of the College of Medicine, University of Dammam, and King Fahd Hospital of the University Al-Khobar, data were collected for all male patients with fractures and dislocations admitted to the hospital between 1 January 2004 and 30 June 2009 through computer-based ICD codes using the UltiCare system. The inclusion criteria were fractures of the femur and tibia in patients ≥12 years of age treated by IMN, who were admitted after the trauma. All pathological fractures were excluded. The fracture patterns were classified according to the Orthopedic Trauma Association system,[14] and open fractures were graded using the Gustilo system.[15]

The medical records were reviewed, and data gathered included the mechanism of injury, age, fracture level, the mechanism of injury (classified as due to road traffic accidents, motorcycle accidents, fall from a height, sports-related and miscellaneous, e.g. crushing injury and assault), associated injuries, and complications. The data were cross-referenced against data recorded in the ward admission log books and operating room registers for completeness and accuracy.

The time of injury, time of surgical intervention and delay in surgical fixation were meticulously documented. Type of anesthesia, duration of surgery, blood loss, and per-op transfusion were also recorded. Early or late postoperative complications and any revision needed were documented. Evaluations of treatment failure were done in terms of need for secondary operative treatment, salvage internal fixation, infection, and delayed, mal or non-union. Data were entered in the database and analyzed. Two-tailed non-paired Student's t-test was used to compare means between patients who were operated under emergency versus elective conditions. Analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 14.0 (Chicago, IL, USA). A p value of <0.05 with 95% confidence interval (CI) was used to indicate statistical significance.

RESULTS

There were 431 fractures of the tibia, fibula and femur. Table 1 shows the demographic data of the patients and causes of fractures. The majority of the patients were in the younger age group of less than 40 years. The age-specific incidence showed a bi-modal age distribution, with one peak in the second decade and a second major peak in the fourth decade. Two hundred and forty-eight (57.5%) of the injuries were sustained due to road traffic accidents. Out of 431 patients, 109 (25.3%) had associated injuries to the head (29) and chest (47) and blunt trauma to the abdomen (63). These commonly included subdural hematoma, brain contusion, rib fractures, lung contusion, liver laceration, and splenic injuries. Three cases had cervical injury (not requiring fixation) and one patient had thoracic aorta rupture, which was operated on an

Table 1. Demographic data and causes of fractures

Age (years) mean: 28.9±14.6
<40 years: 326
>40 years: 105

Mechanism of injury	Number of patients
Motor vehicle accidents	192
Motorcycle	56
Pedestrian	65
Fall at home	25
Sports	46
Fall from height	37
Industrial	9
Gunshot	7
Fireworks	3

emergency basis; the femur in this patient was fixed after two days as an elective procedure.

One hundred and ninety-five patients sustained femoral fractures, whereas 236 were tibial fractures. There were 196 compound fractures (Gustillo I=98, Gustillo II=60 and Type III=38). Two hundred and seventeen (50.3%) were operated as elective procedure and the rest as emergency procedures. Table 2 shows the details of the 195 femoral fractures, of which 105 (53.8%) were operated as elective and 90 (46.2%) as emergency procedures. Operating time for femur fracture as an emergency procedure was significantly greater than in the elective group (191±79 versus 155±65 minutes; p≤0.001, CI -19.54) and the number of overall complications observed in elective procedures was 23 compared to 54 in the emergency group. For femur fracture, recon intramedullary nails were used in 17 patients (12 elective, 5 emergency). Distal femoral nail was used in three elective cases and two emergency surgeries. In the remaining 173 patients, antegrade interlocked femoral nail was used. All intramedullary femoral nailing was reamed and cannulated. All nails for the tibia were unreamed solid nails (A.O.).

There were 236 tibial fractures; 111 (47%) were operated as an elective procedure and 125 (53%) as emergency. The duration of surgery was significantly higher in the emergency procedures when compared to the elective nailings (167.1±62 versus 69.2±35 minutes; p<0.001, CI <-85.4). Complications in the emergency procedures were significantly higher, at 63, versus 30 in the elective group (Table 3).

DISCUSSION

Femoral fractures occur in about 37.1 per 100,000 person-years in the United States, may be life-threatening and may be the cause of permanent disability if the treatment is delayed. IMN is the preferred method for treating such fractures. In general, IMN results in high union and low complication rates.[16] Many factors influence the results of IMN, and our study showed increased complications when IMN was done as an emergency procedure without the availability of

Table 2. Details of femoral IMN done as elective versus emergency procedure

	Femur fracture (n=195)			
	Elective	Emergency	p	CI
Number of patients	105	90		
Duration of surgery (mins)	155±65	191±79	0.001	<-19.54
Infection	5	14	0.01	<0.016
Fat embolism	3	2	0.9	<0.702
Secondary surgery	11	29	0.001	<-0.0607
Non-union	4	9	0.05	<0.050

IMN: Intramedullary nailing; CI: Confidence interval.

Table 3. Details of tibial IMN done as elective versus emergency procedure

	Tibia fracture (n=236)			
	Elective	Emergency	p	CI
Number of patients	111	125		
Duration of surgery (mins)	69.2±35	167.11±62	<0.001	<-85.4
Infection	6	18	<0.001	<-7.35
Fat embolism	7	4	<0.24	<7.993
Secondary surgery	11	27	<0.001	<9.88
Non-union	6	14	<0.008	<-3.351

IMN: Intramedullary nailing; CI: Confidence interval.

a specially trained nursing staff.

We observed a statistically significant increase in the duration of surgeries, blood loss, wound complications, infections, revision surgeries, and delayed unions. Technical errors like prominence of nail or locking bolts causing early removal of implants were seen more commonly in patients operated at night. Delayed and non-union after IMN of the femur is reported to be less than 10%,[17,18] and in tibial fractures, the incidence was 8-16%.[19] In this study, the incidence of non-union in femur fractures was 5.69% and in tibia fractures was 8.47%, but the incidence was significantly higher in patients who underwent surgery as an emergency procedure at night as compared to a daytime surgery.

We believe that the increase in complications in emergency nailings was due to the following factors - an inexperienced operating room staff, which includes the scrub nurse, circulating staff and the image technician, and an unforeseen need for specialized instruments/ inventory. Our results are similar to Bhattacharya et al.[20] for closed femoral nailings done at night. A literature review[21-24] shows that operating during the daytime decreases morbidity, and our results concur with the cited reports. Bhattacharya et al.[20] observed that inexperienced operating room personnel contributed significantly to the increased surgical time required in cases operated after 5 p.m. Ricci et al.[18] stated that daytime orthopedic surgeries have the potential to reduce minor complication rates for intramedullary nail fixation. Elder et al.[22] in a retrospective analysis found statistically significant improvement in surgical outcome when IMN was performed in dedicated orthopedic trauma centers. Lemos et al.[13] remarked that operating in the daytime decreases morbidity, and further added that part of this effect may be related to a more optimal nutrition and hydration status. To reduce complications in elderly patients, Zagrodnick and Kaufner[25] suggested that it is advisable to operate as an elective rather than emergency procedure in femoral fractures so that proper assessment can be made. It was reported earlier that in fixation of fractures as an emergency procedure versus before 72 hours, there was no difference in complications between the two groups.[26] Among the systemic complications seen in this study, infection occurred in 19 patients after femur nailing and in 24 patients after tibial nailing (elective 11, emergency 32). These patients were followed by an infections team and required intravenous antibiotic, and surgical debridement was required in 13 cases. Fat embolism occurred in 16 patients (elective 10, emergency 6), and all of them were successfully managed initially in the surgical Intensive Care Unit.

Trauma surgery at night is always challenging, even more so when trained nurses and surgical technicians are not familiar with the orthopedic instrumentation. Under these circumstances, any surgery performed could lead to increased risk of complications due to which the patient ultimately suffers.

There are certain limitations of our study: First, this study is retrospective in nature and observational in design; secondly, the etiology of complications reported may be multi-factorial, which was not studied.

In conclusion, the authors believe that a subgroup of patients (closed tibial or femoral nailing) with stable vitals should be operated preferably in the daytime if trained orthopedic staff are not available during the night shift. Saudi Arabia has made strides in medical care comparable to that of developed countries, but there is still room for improvement in the care of trauma patients, particularly the development of dedicated orthopedic trauma theaters with 24-hour availability.

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