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The management of ankle fractures in octogenarian and nonagenarians. What is the optimum mode of treatment?

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Abstract

Introduction: The rapidly growing elderly population is living longer, active lifestyles with significant comorbidities. Modern literature challenges the conservative approach to elderly ankle fractures. Our aim is to investigate the outcome of ankle fractures in patients aged over 80 years of age by treatment modality.

Methods: We retrospectively reviewed all consecutive displaced ankle fractures requiring admission in patients over 80 years old at our level 1 trauma centre over 5 years. Conservative management was compared with open reduction and internal fixation (ORIF) and external fixation (Ex-Fix) as a mode of definitive treatment. Primary outcomes measures included length of stay, wound complications including infection, thromboembolic disease and mortality.

Results: We reviewed 35 fractures with 9 Ex-Fix, 6 ORIF's and 20 managed conservatively. Surgical intervention resulted in longer lengths of stay compared to conservative management with a median length of stay of 19.5 compared to 51 in the surgical group ($p=0.006$). ORIF provided good reduction at a cost of wound infections and the need for further procedures. Ex-Fix had the highest risk of mortality and risk of malunion (33%). Conservative management experienced malunion in 25% but avoided the surgical complications.

Discussion: Complications were experienced in all groups reflecting the difficult management decisions posed in these patients.

A patient-by-patient assessment and discussion is key to assess function and physical demands. For low demand and frail patients conservative therapy is a logical choice. ORIF can be considered in the more active and independent as long as the risks are fully understood.

Keywords: Ankle fracture, elderly, management, surgery

1. Introduction

The United Kingdom is following the world trend with an increasingly elderly population with three million people over the age of eighty years old ^[1]. This trend is set to continue with life expectancy at birth currently standing at 83 years for women and 79.3 for men ^[2]. The population is living longer, active lives with coexisting medical problems increasing their risk of fall and fracture including heart disease, eye disease, diabetes, obesity and poly-pharmacy ^[3, 4]. It is therefore no surprise that the incidence and severity of ankle fractures in the geriatric population is increasing and is the most common lower limb fracture in this group ^[1, 3-5]. This poses a significant economical and physical burden on the health care service. The health service estimates that 47% of all admissions to hospital are greater than 65 years old with the most common reason for admission being falls ^[8, 9]. These patients have longer lengths of stay than non-elderly patients and are a significant cost to the health service with an average hospital bed costing £260 day on the background of constant bed pressures ^[3]. These patients often do not get back to the pre-injury state with a frequent requirement for rehabilitation before going home or require a change of residency to either a residential or nursing home ^[10]. The literature is not clear with what age is defined as elderly. The majority of the literature class greater than 65 years old as elderly ^[2, 3]. However, there is a clear difference in patient physiology, physical demands and requirements over the age of 65 years. As with all fracture management the goal is to achieve a stable, anatomical reduction and early range of movement

to facilitate a good recovery and functional outcome [7]. There is controversy over the optimal management of ankle fractures in these physiologically complex patients clouding decision making.

Traditional teaching is that surgery is best avoided as it is associated with increased complication rates, poor outcomes and greater hospital length of stay [2-4]. The poor bone quality associated with the elderly is a risk for fixation failure increasing need for revision surgery or malunion [7]. Significant comorbidities including obesity, vascular compromise and diabetes have negative effects with slow or impaired wound and bone healing predisposing to infection and non-union [1-3]. However, there is a change in recent literature with evidence showing favorable results for operative fixation in the elderly (>65yrs) population [15, 16].

There is sparse literature involving the management of ankle fractures in patients greater than eighty years old. Ankle fractures in this elderly cohort poses a difficult management decision but is a problem that all emergency doctors and trauma surgeons will face with increasing frequency. Our aim is to review our data for ankle fractures greater than eighty years old to determine the optimum management.

2. Methods

We retrospectively reviewed all consecutive displaced ankle fractures in patients over 80 years old at a level I trauma centre over a 5- year period that required admission. Inclusion criteria included all patients greater than 80 years old with a displaced, open or closed Weber B or C ankle fracture. Exclusion criteria included all patients less than 80 years and those with Weber A ankle fractures.

All patients underwent initial management according to ATLS principals with emergency department radiographs. Open wounds were managed in line with BOA/BAPRAS guidelines. Displaced fractures, with talar shift were manipulated in the emergency department and stabilized in a cast. We took a pragmatic approach to treatment using external fixation (Ex-Fix) in cases with persistent ankle subluxation or soft tissue injury and open reduction and internal fixation (ORIF) in anesthesiologically fit patients with good pre-morbid function. Conservative management was performed with serial casting in patients with amenable fracture configuration, high anesthetic risk or low functional demand.

Both ORIF and Ex-Fix patients were assessed and compared to conservative management. Conservative management included application of a cast or manipulation under anaesthesia. Primary outcomes measures included length of stay and complications including wound infection, malunion, thromboembolic disease and mortality.

All statistical analysis was performed using IBM SPSS Statistics Version 22 (IBM SPSS Statistics for MAC, Version 22. Armonk, NY: IBM Corp).

The data was assessed for normality using a Shapiro-Wilk test ($P>0.05$) and was found to be non-parametric due to significant skewness and kurtosis. Thus the analysis of the data was performed using median values and a Mann-Whitney U test, a non-parametric statistical test with a pre-determined P-value of <0.05 . To determine the significance of variables between the groups a multivariate analysis was performed.

3. Results

We reviewed 35 displaced ankle fractures in patients over the age of 80 years old over a five-year period. Of these fractures 33 of these were closed injuries, 2 were open injuries.

In the operative group 9 underwent Ex-Fix as the definitive method of fixation. Six patients underwent ORIF. Of these, two patients initially had a spanning Ex-Fix applied for the management of the soft tissues before undergoing definitive ORIF.

From the analysis, patients who underwent surgical intervention had longer lengths of stay compared to the conservatively managed group ($p=0.006$). (Table 1). There was no statistically significant difference in length of stay between ORIF or Ex-Fix ($p=0.443$).

To establish if there were any patient related factors between the groups that may have increased the risk of developing complications, a multivariate analysis was performed. This found that there were no statistically significant patient related factors between the groups when considering age, ASA grade, diabetes, male/female sex, vascular disease or the open or closed nature of the injury itself.

There were complications with conservative and surgical management reflecting the difficult management decisions posed in these patients (Table 2). Conservative management provided the least amount of severe/life threatening complications but at the expense of a higher rate of malunion and residual talar shift. ORIF and Ex-Fix had considerable complications. ORIF provided better reduction and no cases of malunion but this was at a cost of wound infections, pulmonary embolus and the need for a further procedures. Ex-Fix had the highest risk of mortality and malunion (33%)

A multivariate analysis to assess the potential risk factors for developing complications was performed (Table 3). This analysis found that underlying vascular disease and Ex-Fix were statistically significant for increased rates of mortality following ankle fracture in this elderly cohort.

Infection, as a surgical related complication was found to be statistically significant for both Ex-Fix and ORIF ($p<0.005$). Diabetes as a known risk factor for infection was also significant with all infected cases being diabetic.

Fracture malunion was not related to any patient related factor but management decisions alone with Ex-Fix and conservative management being statistically significant for developing malunion.

Table 1: Management and median length of stay of subjects undergoing conservative versus surgical procedures for ankle fractures.

Management	No of subjects	Median length of stay (days)	P value
Conservative	20	19.5	
ORIF	6	47	0.048
External fixation	9	52	0.014
Surgery	15	51	0.006

Table 2: Complications associated with the different management options used

	Death	Wound infection	Further procedure	PE	Malunion/ Residual talar shift
Conservative	1 (5%)	0	0	0	5 (25%)
ORIF	0	2 (33.3%)	1 (16.6 %)	1 (16.6)	0
Ex-Fix	3 (33.3%)	3 (33.3)	2 (22.2%)	0	3 (33. %)

Table 3: Multivariate analysis for complications experienced in elderly (>80yrs) ankle fractures

	Death	Infection	Malunion
Age	0.879	0.346	0.601
Length of stay	0.182	0.071	0.607
ASA	0.313	0.250	0.988
Diabetic	0.777	<0.005	0.200
Sex	0.798	1.000	0.560
Vascular	0.030	0.080	0.874
Open/Closed	0.224	0.339	0.339
Ex-Fix	0.016	<0.005	<0.005
Conservative	0.177	0	<0.005
ORIF	0.348	<0.005	0

4. Discussion

There is frequent variation in clear definitions of what constitutes the elderly population. Age greater than 65 years old is frequently quoted as elderly. What is not addressed and frequently overlooked is the difference in chronological age and physiological age of the patient that may influence the management approach used. There is a debate of how best to treat the elderly patient with an ankle fracture. Traditional teaching advocates conservative management through manipulation and casting as the risks of surgery outweigh the benefits. However, there is evidence to suggest that some patients may do functionally better with surgery.

From our results octogenarians with surgically managed ankle fractures have a longer median length of stay than patients managed conservatively. There was no difference between lengths of stay when comparing ORIF vs Ex-Fix. A multivariate analysis found no difference in ASA grade, diabetes, male/female sex, vascular disease or the open or closed nature of the injury between the groups. However, the groups did differ in terms of complications they experienced.

A multivariate analysis of risk factors found that pre-existing vascular disease and undergoing Ex-Fix significantly increased risk of mortality. As would be expected, pre-existing vascular disease increased the risk of cardiovascular events and death. Ex-Fix as a surgical procedure increases length of stay and therefore relative immobility increasing the risk of severe complications. These include respiratory complications, skin breakdown and risk of thromboembolic events that could increase mortality. When assessing factors related to infection, diabetes and surgical intervention were significant risk factors. This supports the rationale behind conservative therapy in that the elderly frequently have a poor nutritional state and have pre-existing comorbidities that hinder wound healing, such as diabetes.

Advocates of surgical intervention report 80-85% of patients return to their pre-hospital residence and mobility [3, 4]. However, there is a clear discrepancy in the literature in relation to reported complications with surgery. We have shown that ORIF improved anatomical reduction and prevented malunion consistent with the finding of Herscovici *et al* and Urruela *et al* who also demonstrated that ORIF reduced the rate of non-union and residual talar shift [4, 6].

However, our patients who underwent ORIF experienced wound infections (33%), thromboembolic disease in the form of a pulmonary embolus (16%) and one patient who required a further procedure to combat the infection (16%). Complications in surgically managed patients have varied reports in the literature. Little *et al* reported similar complication rates and outcomes in geriatric compared to non-geriatric fractures managed by ORIF [3]. However, Srinivasan *et al* and Shiverathke *et al* reported good outcomes but at a

cost of considerable time in hospital and complications including wound complications (9.2-10%), malunion and a reported mortality rate of 3-5.4% [17, 18]. Wronka *et al* supported ORIF but experienced wound infection in 13% [3]. Ehrenfeund *et al* reported lower complications rates with only 3.3% experiencing wound complications but AOFAS and linear analogue scales reported lower outcomes for the elderly cohort when compared to those under 65 years old [20]. Fong *et al* attributed surgical complications to non-compliance in this age group with patients often unable to physically off-set weight from the injured limb [21]. Adjuncts to fixation, such as Ex-Fix have found to be useful with associated open or high energy trauma, compartment syndrome and polytrauma patients [2]. If circumstances require the Ex-Fix can be used as a method of definitive fixation although its role and associated complications in the elderly has not been fully explored [22].

In our report patients who underwent Ex-Fix as a mode of definitive management suffered the greatest risk of mortality (33%), wound infection (33%), malunion (33%) and required further procedures to correct deformity and treat infection. Although this suggests that surgery and in particular Ex-Fix has the greatest amount of complications, we have to consider that confounding factors may influence the surgical decision choice, such as pre-existing disease allowing surgeons to consider Ex-Fix as the least invasive surgical intervention.

Conservative management as expected had the lowest rate of serious/life threatening complications, although the trade off was an increased rate of malunion. From our results conservative therapy and Ex-Fix were significant risk factors for developing malunion. A number of confounders could contribute to this, such as the presence of psychological disturbance and cognitive impairment including depression, delirium and dementia which is frequently present in this cohort [2, 3]. This may increase risk of non-compliance with management plans, such as weight bearing status and may increase rates of malunion and loss of anatomical reduction. This is coupled with the physical difficulty of non-weight bearing or partial weight bearing that is frequently impossible to achieve in the elderly.

Clearly this is sub-optimal in terms of fracture management as the aim is to achieve a congruent joint. However, conservative therapy avoids the significant surgical risks. Indeed a prospective randomized controlled trial by Salai *et al* showed improved American Orthopaedic Foot and Ankle Society (AOFAS) scores with conservative treatment over surgical intervention in patients over 65 years [25].

The major limitation of the study is the small numbers in the surgical cohort. However, this is likely to represent overall clinical practice with small numbers undergoing surgery. The overall risk of mortality in this study following ankle fracture was 11% (4/35). This closely mirrors inpatient related mortality for hip fractures. This is likely to reflect the relative immobility that patient incur with fractures and the risk of life threatening complications, such as venous thromboembolism and respiratory infections. Therefore, we feel ankle fractures in the elderly should be considered as serious as a hip fracture and thus be subject to the same combined rigorous medical and surgical care that is standard in fractured neck of femur.

5. Conclusion

The management of elderly patients with ankle fractures needs careful consideration and planning on a case-by-case basis. ORIF provides the best chance of joint congruity with reduced malunion rates. However, surgery does increase risk of complications including infection and thromboembolic

disease. Ex-Fix was related to increased mortality, infection, revision surgery and malunion making this the least favorable option. Despite the chronological age of these patients, the physiologically active and young patients may be considered for surgical intervention as long as they are fully informed of the potential risks associated with it.

6. Conflict of Interests

None of the authors report any conflict of interest.

7. Acknowledgements

None

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