

ORIGINAL ARTICLE

Management of complex ankle fracture: A Ghanaian experience

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Ankle fractures are among the most common conditions for surgical emergencies in most developing countries including Ghana. Despite the fact that many ankle fractures are uncomplicated, a high proportion may require surgical intervention. Decision-making depends on recognition of the fracture pattern, availability of surgical implants and anaesthetic materials. In resource-limited settings where patients are unable to afford the cost of surgical implants and anaesthetic materials associated with ankle fractures, suggested modification of the open reduction and internal fixation (ORIF) technique have proven to yield satisfactory results. This study retrospectively assessed the effectiveness of the modified ORIF method among Ghanaians living within the Tamale metropolis, a resource-limited setting located in the Northern Region of Ghana. The study reviewed 70 cases of bimalleolus fractures which were either treated using the ORIF based on the Association for the Study of Internal Fixation (ASIF) protocol or a modified version of the ORIF which involves internal fixation of the malleolus without screws. The findings indicate that the modified method is as good as ORIF (based on ASIF protocol) with added benefits such as shorter operation time, reduced risk of anaesthetic complications and cost of operation (anaesthetic agents and orthopaedic implant cost) as well as reduced number of foreign bodies (implants) leading to a lower risk of wound infections. The use of this method however demands that foot and ankle joint must be handled with extreme care so as not to dislocate the tibia malleolus post-operatively.

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INTRODUCTION

As a weight-bearing joint, the ankle can absorb great amount of shock and pressure up to about 6 times the individual's body weight (Carr *et al.*, 2003). Excessive amount of energy across the ankle joint can lead to fracture. Ankle fractures are considered the most common of all fractures treated in hospitals (Yang *et al.*, 2011). In the United States of America (USA), the incidence per year of ankle, tibia and fibula fractures is about 492,000. (Praemer *et al.*, 1992; Weening and Bhandari, 2005) and in the United Kingdom (UK), documented incidence rate of fractures is 14.8% per 10,000 persons per year (Van Staa *et al.*, 2001). In Africa however, the incidence is expected to be higher due to additional

high incidence of road traffic accidents (Tiwagirayezu *et al.*, 2008). Road traffic accidents are said to account for about 46.3% of ankle fractures in Nigeria (Ifesanya and Alonge, (2012) and about 71.5% of lower limb fractures in Rwanda (Tiwagirayezu *et al.*, 2008)

The management of ankle fracture in the general populace has been documented to range from non-operative restriction to open reduction and internal fixation (ORIF). Irrespective of management method, anatomic alignment of the ankle joint and complete healing are major factors which can ensure long-term treatment success (Dahners, 1990; Egol *et al.*, 2000) and to prevent arthritis due to abnormal pressure distribution because of malunion of the ankle fracture (Ramsey and Hamilton, 1976). The quality of bone and related cartilage injury, age and alignment of the joint surface (Walheim and Akerman, 1936; Klossner, 1962) as

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well as the type of fracture (Lindsjo, 1985) are other factors to consider during management. However, ORIF is said to offer a potential for more rapid recovery than non-operative treatment (Lindsjo, 1985; Porter *et al.*, 2008). Congruent joint, fracture union, functional motion, normal strength and optimal recovery time are the main objectives of any management method of ankle fracture (Jelinek and Porter, 2009). In a resource-limited setting where availability and accessibility to surgical implants and anaesthetic materials is a major problem coupled with the fact that the community dwellers may not be able to afford the cost of surgical implants and anaesthetic materials, a modification of the method may be necessary. This study retrospectively assessed the effectiveness of the modified ORIF method among Ghanaians living within the Tamale metropolis and its surrounding environs, a resource-limited setting located in the Northern Region of Ghana.

PATIENTS AND METHODS

Study site and participants

A total of 70 patients who received complex ankle fracture or bimalleolus fracture management at the Tania Specialist Hospital between September 2005 and September 2010 were included in this retrospective study. Patient characteristics (age and gender), fracture type, mechanism of injury and treatment type were retrospectively reviewed. After review of patient data, the subjects were grouped into two based on method of treatment. Group one (n = 35) was treated with open reduction and internal fixation (ORIF) using principles of the Arbeitsgemeinschaft Osteosynthesefragen (AO/ASIF) group. The second group (n = 35) was treated with modified ORIF without syndesmosis and medial malleolus lag screws. All surgical cases were performed by a consultant orthopaedic surgeon and were usually done after initial physical and photographic assessment of the patient to confirm the position and 'personality' of the fracture. Radiographs taken at 2 and 6 weeks of treatment in both methods were also reviewed.

Treatment Procedure

All patients treated by ORIF with AO/ASIF principles followed the under listed protocol;

- a. Open reduction of laterally dislocated tibia malle-

- olus and stabilization with lag screw(s)
- b. Open reduction of fibular fracture with unstable syndesmosis
- c. Reduction of lateral dislocated Talus
- d. Fixation of syndesmosis with screw(s)
- e. Application of below knee splint for 7-10 days
- f. Application of knee circular POP after 7-10 for six weeks
- g. Removal of POP and start of physiotherapy and partial body weight bearing (15 kg) for start increasing over six more weeks

The major outcome is the anatomic fixation of the ankle joint which allows for early return to functional range of motion.

The rest of the patients who were treated with modified ORIF without bimalleolus lag screws followed the under listed procedure;

- a. Open reduction of laterally dislocated tibial malleolus and stabilization with Vincryl-2 suture (first as pair-string and fortified with Z-shape suture) over deltoid ligament without lag screws.
- b. Reduction of laterally dislocated Talus
- c. Fixation of syndesmosis with screw(s)
- d. Application of below knee splint with extreme care for 10 days
- e. Application of knee circular POP for six weeks
- f. Removal of POP and start of physiotherapy and partial weight bearing of 15 kg body weight for the start, increasing over six more weeks.

Statistical Analysis

All categorical variables were expressed as proportions and were compared using Fisher's exact test. In all statistical tests, a value of $P < 0.05$ was considered significant. All analysis was performed using GraphPad Prism 5.10 for windows (Graphpad software, San Diago, CA. USA).

RESULTS

From this study, plate 1A shows a radiograph of pre-operative fracture (*in the direction of the black arrow*). Plate 1B shows a radiograph of the ankle joint after stabilization using the modified ORIF method (*in the direction of the white arrow*) compared to Plate 1C which is a radiograph of the fracture after heal-

ing following the ORIF (AO/ASIF) (indicated with a white arrow).

From the retrospective review of available data, the general cause of injury was road traffic accident which accounts for 88.6% (62/70) of all recorded ankle fracture cases followed by direct blow (10.0%) and falls from heights (1.4%) as shown in Table 1.

Table 1: Aetiology of fractures

Aetiology	No. (%)
Road traffic accident	62 (88.6)
Direct blow	7 (10.0)
Fall from a height	1 (1.4)
Total	70 (100)

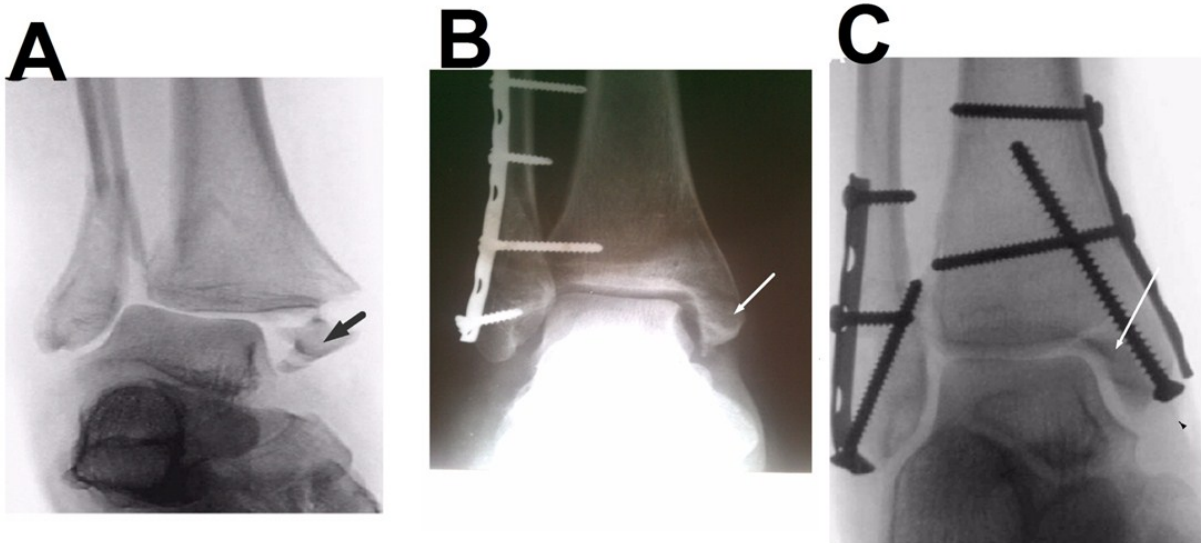


Plate 1: Radiographs of **A)** pre-operative fractures with an arrow (black) showing the medial malleolus; **B)** post-operative treatment without medial malleolus screw(s) indicated by the arrow (white); **C)** post-operative treatment with medial malleolus screw(s) indicated by arrow (white).

In this study, 85.7% (60/70) of the patients were males with only 14.3% (10/70) being females. The mean age of the patients was 36 ± 9 years with a range of 11-65 years. Majority of the patients (62.9%) were within the 31-50 year age bracket as shown in Table 2. The recovery period for the patients ranged from within 3 months to 6 months with about 67.4% (47/70) gaining full recovery within 3 months and the remaining 32.9% (23/70) recovering within 3-6 months post-operation. When the rate of recovery between the subjects treated with the AO/ASIF was compared to those treated without the malleolus lag screws, there was no significant difference ($P = 0.8075$). There was no significant difference in the recovery period between men and women as shown in Table 2. Although

younger subjects tendered to heal early there was no statistical significant difference in healing among the subjects with respect to patient age. After one year of follow up there were no post-operative complications such as deep wound infections and reflex sympathetic dystrophy in both groups.

DISCUSSION

This study reports ankle fracture incidence of 88.6% resulting from vehicular road traffic accident (RTA). This high figure could be attributed to the high number of motor cycles in the three Northern regions. According to the Regional motor traffic unit majority of users of these motor cycles are without driving licence leading to careless and reckless driving culminating in the high incidence of

Table 1: Relationship between fracture healing time and patient age, method of fixation and gender

Variable	Healing time		Total	P value
Age (Yrs)	Within 3 months	3-6 months		
10-20	2(100.0%)	0(0.0%)	2	
21-31	9(52.9%)	8(47.1%)	17	
31-40	12(57.1%)	9(42.9%)	21	
41-50	13(56.5%)	10(43.5%)	23	
51-60	3(60.0%)	2(40.0%)	5	
61-70	0(0.0%)	2(100%)	2	
Method of stabilization				
ORIF(AO/ASIF)	22(62.9%)	13(37.1%)	35	P = 0.8075
ORIF (without screws)	20(57.1%)	15(42.9%)	35	
Gender				
MALE	35(58.3%)	25(41.7%)	60	P = 1.000
FEMALE	6(60.0%)	4(40.0%)	10	

road traffic accidents (*personal communication*). The high vehicular related ankle injury reported in the present study is in conformity with results of similar studies in other parts of Africa which indicated that road traffic accidents are the leading cause of ankle fractures in Africa (T'wagirayezu *et al.*, 2008).

Proponents of open reduction and internal fixation suggest that restoration of the normal anatomy will reduce the risk of subsequent osteoarthritis due to incongruence (Weber, 1966). In areas where surgical implants are not readily available or accessible, surgeons find it difficult to manage complex ankle fractures leading to complications such as arthritis and bacterial infections (Ifesanya and Alonge, 2012). According to Steiner and Kotisso (1996), it is not clear whether or not internal fixation should have a place in Africa. It is often argued that there would be too many infections and other complications because in Africa there is neither adequate training in internal fixation nor adequate infrastructure in the operating theatre (Steiner and Kotisso, 1996). This perception is however changing with the establishment of specialist hospitals around Africa. In this study internal

fixation of bimalleolus fracture without lag screw has proven successful with added benefits such as a shorter duration of surgical process, reduced risk of anaesthetic complications, reduced cost of operation (anaesthetic agents and orthopaedic implant cost) and reduced number of foreign bodies (implant) leading to a lower risk of wound infections. Clinical studies have consistently failed to show any difference in outcome between fractures treated operatively and those managed conservatively. The findings of the present study is similar to Yde and Kristensen (1980) who compared operations based on ASIF techniques with closed treatment and immobilisation in a plaster cast and found no difference in outcome at a minimum follow-up of three years. The modified ORIF procedure without lag screws also ensures early restoration of anatomical function similar to the ORIF based on ASIF principles. There were no post operative complications such as deep wound infections and reflex sympathetic dystrophy which are usually associated with the ASIF procedure as reported by Paudel (2011) giving this procedure an added advantage.

CONCLUSION

The results of this retrospective study suggest that the modified ORIF treatment protocol for complex ankle injuries is safe, satisfactory and equally effective with good functional outcome similar to the AO/ASIF ORIF treatment protocol which uses screws for internal fixation. The use of the modified ORIF protocol however demands that foot and ankle joint must be handled with extreme care so as not to dislocate the tibia malleolus post-operatively.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

- Carr J.B., Browner B.D., Jupiter J.B. and Levine A.M. (2003) *Malleolar fractures and soft tissue injuries of the ankle.*, 3 ed. Philadelphia: Saunders.
- Dahners L.E. (1990) The pathogenesis and treatment of bimalleolar ankle fractures. *Instr Course Lect* 39, 85-94.
- Egol K.A., Dolan R. and Koval K.J. (2000) Functional outcome of surgery for fractures of the ankle. A prospective, randomized comparison of management in a cast or a functional brace. *J Bone Joint Surg Br* 82, 246-249.
- Ifesanya O.A. and Alonge O.T. (2012) Operative stabilization of open long bone fracture: A tropical Tertiary hospital experience *Nigeria Medical Journal* 53, 16-20.
- Jelinek J.A. and Porter. D.A. (2009) Management of Unstable Ankle Fractures and Syndesmosis Injuries in Athletes. *Foot Ankle Clin N Am* 14, 277-298.
- Klossner O. (1962) Late results of operative and non-operative treatment of severe ankle fractures. A clinical study. *ActaChirScandSuppl* 293, 1-93.
- Lindsjo U. (1985) Operative treatment of ankle fracture-dislocations. A follow-up study of

306/321 consecutive cases. *ClinOrthopRelat Res* 199, 28-38.

- Nilsson G., Jonsson K., Ekdahl C. and Eneroth M. (2007) Outcome and quality of life after surgically treated ankle fractures in patients 65 years or older. *BMC Musculoskelet Disord* 8, 127.
- Paudel K.P. (2011) Early weight bearing compared with non-weight bearing functional mobilization after operative treatment of an ankle fracture. *Journal of College of Medical Sciences-Nepal* 7, 40-46.
- Porter D.A., May B. and Berney T. (2008) Functional outcome after operative treatment for distal fibula and tibia fractures in young athletes: a retrospective, case series. *Foot Ankle Int* 29, 887-894.
- Praemer A., Furner S and Rice D.P. (1992) Musculoskeletal Conditions in the United States. Park Ridge, IL: *American Academy of Orthopedic Surgeons.*
- Ramsey P.L. and Hamilton W. (1976) Changes in tibiotalar area of contact caused by lateral talar shift. *J Bone Joint Surg Am* 58, 356-357.
- Steiner A.K. and Kotisso B. (1996) Open fractures and internal fixation in a major African hospital. *Injury* 27, 625-630.
- Tunturi T., Kemppainen K., Patiala H., Suokas M., Tamminen O. and Rokkanen P. (1983) Importance of anatomical reduction for subjective recovery after ankle fracture. *Acta Orthop Scand* 54, 641-647.
- Twagirayezu E., Dushimiyimana J.M.V. and Bonane V. (2008) Open Fractures I Rwanda: The Kigali Experience. *East and Central African Journal of Surgery* 13, 77-83.
- Van Schie-Van der Weert E.M., Van Lieshout E.M., De Vries M.R., Van der Elst M. and Schepers T. (2012) Determinants of outcome in operatively and non-operatively treated Weber-B ankle fractures. *Arch Orthop Trauma Surg* 132, 257-263.
- Van Staa T.P., Dennison E. and Leufkens H.G.M. (2001) Epidemiology of fractures in England and Wales. *Bone* 29, 517-522.
- Walheim T. and Akerman N. (1936) Intraarticular malleolar fractures. *ActaChirScand* 76, 166.

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- Weber B.G. (1966) Die verletzungen des oberen sprunggelenkes. *Bern: Huber.*
- Weening B. and Bhandari M. (2005) Predictors of functional outcome following transsyndes-motic screw fixation of ankle fractures. *J Orthop Trauma* 19, 102-108.
- Yang E., Wu Y. and Dorcil J. (2011) Surgical versus nonsurgical treatment of the SE4-equivalent ankle fracture: a retrospective functional outcome study. *Orthopedics* 34.
- Yde J and Kristensen K.D. (1980) Ankle fractures: supination-eversion fractures stage II: primary and late results of operative and non-operative treatment. *Acta Orthop Scand* 51, 695-702.

