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First Metatarsal Phalangeal Joint Arthrodesis: A Six-year Review

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Introduction

Arthrodesis of the first Metatarsophalangeal Joint (MTP-J) is a well-recognized procedure for the treatment of end-stage arthritis of the hallux. Hallux valgus, hallux rigidus and rheumatoid arthritis are the most common underlying pathologies requiring surgical intervention, according to available literature [1,2]. Modern osteosynthesis techniques include dorsal plate fixation, cannulated screws and k-wires, all of which have been in use for first MTP-J arthrodesis since the 1980s [1,2]. Several studies have shown that non-union is a common complication of first MTP-J arthrodesis, with variable rates quoted in the literature [3-5]. Other reported complications include mal-union, surgical site infections and removal of metalwork [6]. We present the findings of a six-year review of patients who underwent first MTP-J arthrodesis, in order to identify complications including non-union, mal-union and removal of metalwork. The incidence of these complications was then compared against worldwide acceptable rates.

Methods

A retrospective review of patients that underwent 1st MTP-J arthrodesis from January 2010 to January 2016 was performed. We included patients with a minimum of six months of follow up in an outpatient clinic. Data were extracted from the regional electronic database of Merseyside by the first author. Data recorded included patient demographics, indication for procedure, surgical technique used and post-operative complications within the follow up period. No national standards or frameworks are available for this procedure. Frequency of post-operative non-union, mal-union and removal of metalwork were therefore compared against acceptable standards proposed within a systematic review on non-union of 1st MTP-J arthrodesis by Roukis [2]. The author analyzed the indications, osteosynthesis and post-operative complications of 2818 procedures and was therefore deemed a robust alternative to a national standard.

Results

87 patients were included in this study. One patient was excluded due to non-attendance at outpatient follow up. The cohort was predominantly female (female: n=68; male: n=19). Median age was 65 years (range 28 - 83 years). The most frequent indications for surgery were hallux rigidis (n=38), hallux valgus (n=37) and rheumatoid arthritis (n=12) (Figure 1) (Table 1). Less common indications for surgery within this cohort are described further in table 1. Dorsal plate and screws were the surgical technique of choice for 94% (n=81) of the patient cohort. Other approaches included compression screws, k-wire fixation and interfragmentary cannulated screw (Figure 2). 46.5% (n = 40) of the procedures performed were done as a day case. The remaining 46 patients required a post-operative inpatient stay of varying duration (Table 2).

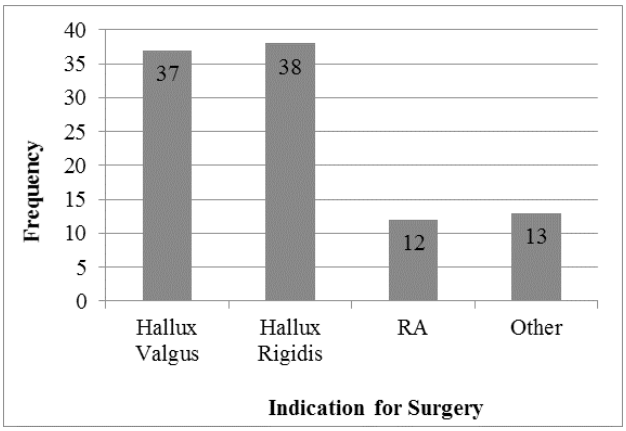

Figure 1: common indications for first MTP-J arthrodesis within the patient cohort (RA – rheumatoid arthritis); patients within the 'other' category is further described in (Table 1).

Less Common Indication for Surgery	Frequency
Psoriatic Arthropathy	3
Dislocated 1st MTP-J	2
Osteoarthritis	2
Wolf Hirschhorn Syndrome	2
Erosive arthritis	1
Reactive arthritis	1
Dysplastic 1st MTP	1
Dorsiflex deformity following open fracture	1
Extension deformity of left hallux	1

Table 1: less frequent indications for MTP-J arthrodesis within the patient cohort.

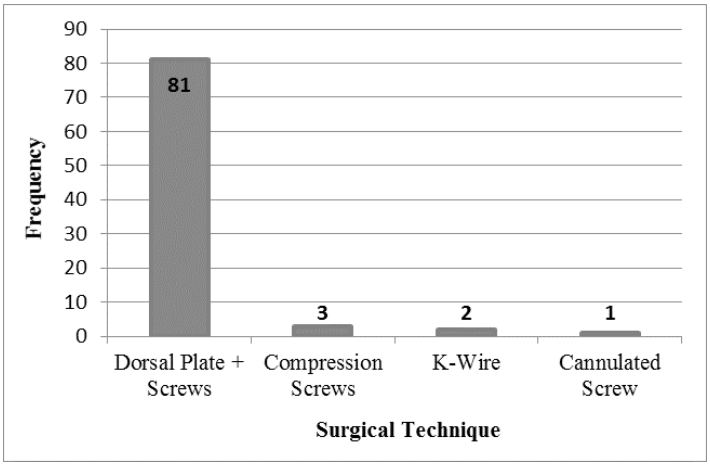

Figure 2: surgical techniques used for 1st MTP-J arthrodesis.

Length of Inpatient Stay	Frequency
1 day	37
2 days	7
5 days	1
15 days	1

Table 2: length of inpatient stay of the 47 patients not on a day-case surgical list.

Of these, the majority required an overnight stay only (n=37). One patient had an inpatient stay of 15 days due to social issues leading to a delay in discharge. Post-operative removal of metalwork was required in 8.1% (n=7), whilst non-union was observed in 3.4% (n=3) patients. No patients were found to have malunion post-operatively. (Figure 3) highlights that these complication rates are less than the worldwide acceptable rate, as proposed by Roukis [2]. Other documented post-operative complications are listed in (Table 3). Surgical site infection was identified as a post-operative complication in 17.5% of patients (n=15) (Table 3). Further investigation found that objective evidence of infection in the form of micro-organism growth from microbiological wound swabs were found in only 6.9% (n=6) of patients, 2 of which were deep wound infections (Figure 4).

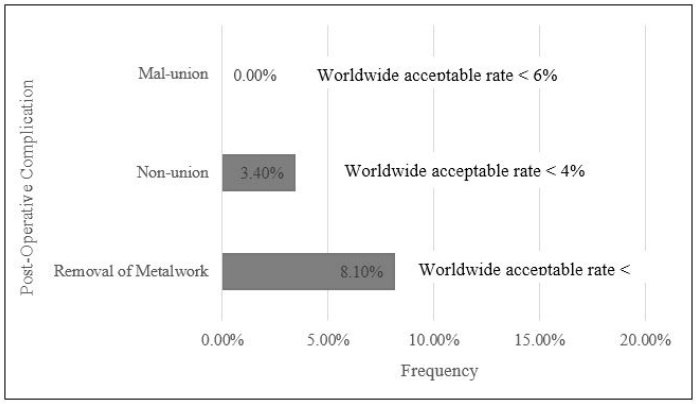

Figure 3: rate of post-operative complications compared to a worldwide acceptable rate proposed by Roukis [2].

Post-Operative Complication	Frequency (n)
Surgical site infection	15
Persistent pain	15
Delayed union	3
Skin irritation	2
Would dehiscence	2
DVT	1

Extension deformity	1
Pressure callosity	1
Osteomyelitis	1

Table 3: documented post-operative complications and their relative frequencies.

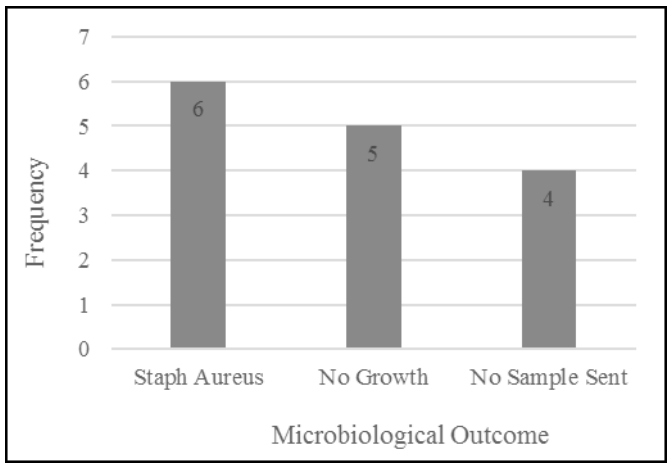

Figure 4: microbiological outcomes for the 15 patients with a post-operative surgical site infection.

Discussion

The patient demographics and surgical indication for this cohort are remarkably similar to previously documented studies [2,7]. We can conclude that hallux valgus, hallux rigidus and rheumatoid arthritis are more common in females and it takes time for the pathology to reach such a severity that surgical intervention is required in order to relieve pain or correct deformity. Roukis's systematic review in 2011 reported 'inappropriately high' incidences of malunion and removal of metalwork at 6.1% and 8.5%, respectively. The incidence of non-union was reported at 5.4% [2]. The authors of this study were pleased to note that complication rates were less than the worldwide acceptable rate first proposed by Roukis. The complication rates of non-union, malunion and removal of metalwork in this cohort are reflective of other studies with similar cohort sizes [3,7,8]. The complication rates from this study and others are encouraging, and show that the targets set by Roukis [2] are being adhered to. This in turn leads to reduced length of inpatient stay and improved patient satisfaction and outcomes.

A comparison of outcomes between genders was not done in this cohort, however a number of studies have found that the complication rates were much higher in male patients [7,8]. The reasons behind this are unclear, however it is an interesting observation and one that operating surgeons should be aware of, particularly during post-operative follow up of patients.

Dorsal plate and screws were the most commonly adopted surgical technique in this cohort, which is reflected in similar studies [3,5]. Cannulated screws are associated with a higher rate of non-union [4], therefore it is pleasing that only one such procedure was performed in this cohort. A retrospective analysis of 72 patients by Dening, et al. [5] found that the use of plate and screws was associated with a decreased rate of non-union compared to screw fixation. This may partly explain the low incidence of non-union within this cohort. A recent study by Latif et al. [9] boasts a 100% union rate using a cannulated lag screw incorporated into a low-profile titanium plate [9]. This shows that whilst the rate of non-union within this cohort was low, improvements can still be made in order to further reduce their incidence.

First MTP-J arthrodesis is a long-standing, safe and efficacious method of relieving pain and correcting deformity, regardless of underlying pathology. Current evidence suggests that dorsal plate and screws are the safest surgical approach, however few studies directly compared techniques. Complication rates are falling below the worldwide accepted rates, but there is room for improvement. Further investigation is required to assess if post-operative complication rates differ according to surgical indication or form of osteosynthesis used.

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