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Keller's arthroplasty in adults with hallux valgus and hallux rigidus

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ABSTRACT

Background: The role of Keller's resection arthroplasty in the management of adult hallux valgus with hallux rigidus is debatable. There are no studies addressing this particular problem.
Methods: This study is a retrospective review of 32 patients (49 feet), conducted by an independent assessor. Subjective and objective criteria were used to assess the results of surgery. There were 30 women and 2 men with an average age at surgery of 62.5 years.
Results: The results of surgery in terms of relief of pain, cosmesis and use of regular footwear were satisfactory. Excellent and good subjective results were obtained in 39% and 37% of cases respectively. Radiological analysis revealed decrease in the intermetatarsal and first metatarsophalangeal angle in a significant number of cases. Final results assessed by Vallier's modification of Bonney and MacNab criteria, revealed excellent to good results in 87% of feet. A significant number of complications were noted but there was no association between the occurrence of complications and the final result or the subjective functional grade. There was no association between the amount of resection of proximal phalanx and occurrence of metatarsalgia or the final outcome.
Conclusion: The results of this study suggest that Keller's arthroplasty has a role in patients with adult hallux valgus associated with degenerative changes in the first metatarsophalangeal joint.

1. Introduction

Hallux valgus and hallux rigidus are some of the common foot problems seen in clinical practise. Patients with hallux valgus alone can be treated with a number of osteotomies, whereas metatarsophalangeal joint fusion is considered the gold standard procedure for hallux rigidus [1]. However some patients present with hallux valgus with associated hallux rigidus. Metatarsophalangeal joint fusion can be done in these patients but at the expense of loss of movement. Implant arthroplasty can be done to preserve movement but is not without its problems [2–4]. Keller's procedure is an option in such patients with the advantage of preservation of movement in the metatarsophalangeal joint, especially in less demanding older individuals. Keller, in 1904 and 1912 [5,6] reported the first two clinical studies using this procedure, which carries until this day his name. From the literature, it is clear that Keller's arthroplasty has been one of the most commonly performed procedures for hallux valgus in the 20th century [7–11]. Unfortunately, in spite of decades of use, the indications, exact technique, complications and results of Keller's arthroplasty remain controversial. It is a technically simple operation which decreases deformity and maintains a functional range of movement of the metatarsophalangeal joint [7–10]. A high percentage of patients report excellent pain relief and satisfaction in terms of increased function, better cosmesis and ability to wear regular (off-the-shelf) footwear [9,10,12]. On the other hand, the critics put forward the main argument that a significant percentage of patients are noted to have metatarsalgia following Keller's arthroplasty. It also results in a short, cocked up and floppy great toe making shoe fitting difficult [13]. Reize et al. have compared Keller–Brandes procedure for hallux valgus and hallux rigidus separately [14]. However there were no recent studies in the literature which looked at hallux valgus associated with underlying hallux rigidus treated by Keller's procedure. The aims of this study were to assess the subjective and objective outcome following Keller's arthroplasty performed for adult hallux valgus associated with hallux rigidus. The objectives included assessment of complications; the difference in the result between patients who were under and over the age of 65 years; the effect of the extent of proximal phalangeal excision on the

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incidence of complications particularly metatarsalgia, the final outcome; and to study the effect of occurrence of complications on the subjective and functional end result.

2. Patients and methods

Thirty-two patients (46 feet) who underwent Keller's arthroplasty were retrospectively reviewed. The surgery was performed between April 1993 and July 1997. The length of follow up after surgery was 1–7 years. The indication for surgery in all feet was painful hallux valgus associated with hallux rigidus. Patients with the primary diagnosis of hallux valgus only, hallux rigidus only or an underlying diagnosis of rheumatoid arthritis were excluded from this study. There were 30 women and 2 men. The right side was operated upon in 19 feet while 27 feet had surgery on the left side. The average age at surgery was 62.5 ± 6.9 years (range 50–83 years). Patients were divided into two groups. The final result was compared in patients who were under 65 years (n = 32) to those over 65 years (n = 14).

Patients were approached with an information sheet about the study and a questionnaire to assess the subjective outcome of surgery. Those who expressed their willingness to participate were sent an outpatient clinic appointment for objective evaluation and follow up radiographs of the foot. This study was approved by the Local Ethics Committee. Data was obtained from their hospital notes and radiographs to record the pre-operative status, details of surgery and follow up evaluation of patients up to the time of discharge. The post-operative complications and residual symptoms were noted.

The questionnaire designed specifically for this study, consisted of questions related to side affected, duration of symptoms, pain, cosmesis, ability to use off-the-shelf footwear, metatarsalgia before and after surgery, and subjective rating of the result of the surgery. Patients were also given an opportunity to make additional remarks about the surgery, which were not addressed by the questionnaire. After patients had consented to participate in the study, detailed clinical examination of the feet in a routine clinic setting and radiographs were performed. Details like additional operative procedures, post-operative complications like metatarsalgia, injury to the dorsal cutaneous nerve, residual shortening and deformity of the big toe were recorded.

Weight bearing radiographs of the foot obtained pre-operatively and at the latest review were measured for metatarsophalangeal angle, intermetatarsal angle and amount of proximal phalanx resected. Stress fractures of the lesser metatarsals were also recorded from the follow up radiographs of the patients. The Bonney and MacNab 12-point grading system (1952) was utilised. This system gives 4 points each for anatomic grade, subjective functional grade and objective functional grade (Table 1). The grading proposed by Vallier et al. [15] was adopted to grade the final results (Table 2).

2.1. Surgical procedure

All procedures were performed under general or spinal anaesthesia. A tourniquet was routinely used unless there was a vascular contra-indication. A straight dorso-medial incision was done beginning at the neck of the proximal phalanx of the first toe to about the middle of the first metatarsal. The capsule of the first MTP joint was entered through a longitudinal incision offset plantarward from the skin incision by 2–3 mm. By sharp dissection, the capsule was raised both dorsally and plantarward until the medial eminence and the proximal half of the proximal phalanx was exposed. The hallux was placed in forced valgus to expose the articular surface of the proximal phalanx and all its soft tissue attachments were removed by sharp dissection. Particular care was taken to avoid damage to the flexor hallucis tendon. After identifying the junction of metaphyseal–diaphyseal portion of the proximal phalanx, one-third of the base of the proximal phalanx was excised using a power saw. The plane of this cut was perpendicular to the long axis of the proximal phalanx. Similarly starting at the para-sagittal grove and directing the power saw plantarly, the medial eminence was excised. The margins of this osteotomy were smoothed with a rongeur and any osteophytes from the metatarsal head were removed. With a power drill, a single 1.6 mm Kirschner wire (K wire) was inserted in the centre of the medullary canal of the proximal phalanx and driven in a retrograde direction through the tip of the distal phalanx, exiting 3–5 mm plantar to the end of the toe nail. The hallux was then placed in 5 degrees of valgus and 10 degrees of extension with respect to the plantar surface of the foot. While holding the toe out to length and in correct rotational alignment, the K wire was drilled into the metatarsal head, neck and shaft. Medial capsulorrhaphy was then performed after excising any redundant capsular flaps. The wound was closed by interrupted non-absorbable sutures. The exposed end of the Kirschner wire was looped and a standard forefoot dressing was applied.

A post-operative radiograph of the forefoot was performed. Each patient was mobilised with the help of support and a special post-operative shoe. The dressing was changed at 10–12 days and the sutures were removed. The Kirschner wire was removed at about 4 weeks as an outpatient procedure unless there was evidence of pin track inflammation. At 4–6 weeks, more weight-bearing activity was permitted with the advice to start active movements of the great toe. Patients were followed up monthly for the first 6 months and then 6 monthly for 12–18 months or till the time of final discharge.

Table 1
Anatomical and functional grading system (Bonney and MacNab).

		Feet	Percentage
Anatomical functional grading			
4	HV less than 20 degrees, No bunion	35	76
3	HV 20–30 degrees, bunion	9	20
2	HV 30–50 degrees, bunion, bursitis	2	4
1	HV more than 50 degrees, bunion, bursitis	0	0
Subjective functional grading			
4	No symptoms or restriction of normal activities	22	48
3	Occasional symptoms, no restriction	15	32
2	Constant symptoms, intermittent limitation	9	20
1	Constant symptoms, total limitation	0	0
Objective functional grading			
4	DF 30 degrees or more, active PF 15 deg.	19	41
3	Marked limitation of either DF or PF	15	33
2	Marked limitations of both DF and PF	10	22
1	No movement possible	2	4

HV, hallux valgus; DF, dorsiflexion; PF, plantarflexion.

2.2. Statistical analysis

All values are expressed as mean ± SD unless mentioned otherwise. The non-parametric Mann–Whitney U test was used to test the difference between two groups. The correlation between the extent of excision of proximal phalanx and the occurrence of

Table 2
Final result of surgery based on grading system of Bonney and MacNab.

Results	Score	Feet	Percentage
Excellent	12	4	9
Good	9–11	36	78
Fair	7–8	6	13
Poor	6 or <	0	0

Adapted from Vallier et al. [15].