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Incidence of hallux valgus primary surgical treatment. Finnish nationwide data from 1997 to 2014

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ABSTRACT

Background: Many surgical procedures have been described for hallux valgus. Evidence provided by the current literature on the different procedures is, however, poor. The purpose of this study was to assess the incidence of HV surgery in Finland between 1997 and 2014 and to find out whether changes in operation techniques of HV have occurred during the study period.
Methods: The study included all adult patients (≥18 years) who underwent primary HV operation. Patients were included into study if they had been operated with a diagnosis of HV (ICD-10 code M20.1). The data were collected by the Finnish National Hospital Discharge Register (NHDR).
Results: The total incidence of primary HV operations was 66.7 per 100,000 person-years in 1997 and 41.4 per 100,000 person-years in 2014. The incidence of arthroplasty operations of the MTP-1 joint decreased while at the same time the incidence of the MTP-1 joint arthrodesis and TMT-1 arthrodesis increased. The gender difference (13% men, 87% women) is consistent with previous studies.
Conclusion: This study shows a significant decreasing trend of HV operations in Finland between 1997 and 2014. During the study period, the incidence of MTP I joint arthroplasty decreased, and since 2005 the incidence of MT-1-osteotomies has almost halved. At the same time, the incidence of MTP-1 joint arthrodesis increased by over 1000% and TMT-1 joint arthrodesis by nearly 2000%.

1. Introduction

It has been estimated that in western countries one third of the population population suffer from a hallux valgus deformity [1]. Although a genetic predisposition has been identified, the etiology and pathogenesis of HV still remain unclear and is thought to be multifactorial [2,3]. HV is defined as a malposition of the first metatarsophalangeal joint (MTP-1). The biomechanics of HV include twisting of the first metatarsal bone to supination and varus malposition in relation to the sesamoid bones and the rest of the foot [1]. In their review, Easley and Trnka suggest that HVA can be defined/categorized (mild, less than 30°; moderate, 30–40°; and severe, more than 40°), while the IMA varies (mild, less than 10–15°; moderate, 10–15°; and severe, more than 15–20°) [4]. In their meta-analysis, Nix et al. estimated that the prevalence of HV is 23% in adults aged from 18 to 65 years and 35.7% in adults aged over 65 years [5].

There have only been a few studies on the conservative treatment of HV, and the effectiveness of these interventions remains unclear [4,6,7]. Du Plessis et al. have, however, reported a reduction in pain and discomfort using night splints or manipulative therapy [8]. To date, only one RCT study has demonstrated that the operative management of hallux valgus has led to superior functional outcome and patient satisfaction compared with orthotic management at a minimum follow-up of 12 months [9]. In their study, orthoses only provided short-term symptomatic relief of HV [9].

Although more than 100 different surgical techniques for the operative treatment of HV have been described, there is still no consensus on the optimal technique or timing of the operation [10,11]. For mild and moderate HV, operative procedures, such as bunionectomy, cheilectomy, various soft tissue procedures, first metatarsal (proximal, diaphyseal and distal) osteotomies (MT-1), are recommended, whereas for more severe deformities, first metatarsophalangeal (MTP-1) and first tarsometatarsal (TMT-1)

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arthrodeses are mainly recommended [11]. Resection arthroplasty has played a historical role in HV surgery. Nowadays, however, it is well known that resection arthroplasty carries a high risk of postoperative metatarsalgia due to the instability and poor function of the first MTP joint [12,13]. First toe phalangeal osteotomies are mainly used as additional procedures.

The distal MT-1 procedure is considered to be relatively easy with fast recovery and few early postoperative complications [14,15]. On the other hand, diaphyseal and proximal MT-1 osteotomies have been thought to be more effective in correcting the deformity compared with distal MT-1 osteotomies [16–18]. The findings of a recent RCT by Lee et al., however, showed no difference in outcome between distal and proximal MT-1 osteotomies [19]. An RCT study by Torkki et al. in 2001 showed that a Chevron osteotomy was an effective treatment for painful HV [9]. Another study by the same group showed that HV surgery was also cost-effective [20].

Arthrodesis of the first MTP joint is an established procedure in the treatment of severe HV [21,22]. The procedure has been shown to reliably reduce the pain caused by HV, improve foot function, and allow a return to previous physical activity [22]. TMT I arthrodesis provides very powerful correction of HV, intermetatarsal I–II angle, and also the rotational deformity of the first metatarsal, which is rarely discussed and not addressed in most HV correcting procedures [23–26].

In their epidemiological study, Saro et al. found a higher prevalence of foot problems in women and showed that HV surgery was by far the most common forefoot procedure in Sweden [27]. The study included 4,409 surgical procedures for forefoot deformities between January 1997 and December 2000 in Sweden and gave a valid estimate of the amount of forefoot and HV surgery performed in six different regions of Sweden, but did not provide national incidence of the primary HV surgery [27].

The main purpose of this study was to assess the incidence of HV surgery between 1997 and 2014 in Finland. A second purpose was also to identify whether any changes in surgical techniques for the treatment of HV had occurred during the study period. To our knowledge, this is the first nationwide epidemiological study that provides comprehensive data on primary HV surgery and surgical techniques.

2. Materials and methods

Founded in 1967, the Finnish National Hospital Discharge Register (NHDR) provides data on age, sex, domicile of the subject, duration of hospital stays, primary and secondary diagnosis, and operations performed during the hospital stay. The data collected by the NHDR is mandatory for all hospitals, including private, public, and other institutions. The validity of the NHDR is excellent regarding both the coverage and accuracy of the database [28–31].

In 1996, the Nordic Medico-Statistical Committee (NOMESCO) published the first printed edition of the NOMESCO Classification of Surgical Procedures (NCSP) [32]. A Finnish translation (NCSP-F) was introduced in 1997, and the Finnish procedural coding changed accordingly. The patient data for this study were therefore obtained from the Finnish NHDR between 1997 and 2014.

For the purpose of this study, we included all adult patients (≥18 years) who underwent HV operation. Patients were included into study if they had been operated with a diagnosis of HV (ICD-10 code M20.1). The procedural codes (according to the Finnish version of the NOMESCO classification) for the HV included NHK30 (MT-1 osteotomy including proximal, diaphyseal and distal ones), NHK99 (other operation on bone of ankle or foot — bunionectomy and cheilectomy) and NHG80 (MTP-1 joint arthrodesis), NHG70 (MTP-1 joint arthroplasty – resection, interposition), and NHG26 (TMT-1 joint arthrodesis). Both outpatient and inpatient operations were included in the study. Since the NHDR does not include laterality of the operation, only the patient's first HV operation (primary) during the study period was included in the analysis.

3. Statistical analysis

To compute the incidence ratios of the HV surgery, the annual mid-population data for each calendar year of the study period was obtained from the Official Statistics of Finland [33]. The resulting rates of operatively treated HV (per 100,000 person-years) were based on the entire adult population of Finland rather than cohort or sample-based estimates. Therefore, in full accordance with our previous national studies, 95% intervals or other statistical estimation methods were not used [34]. Data were analyzed with SPSS Statistics 24 (IBM).

4. Results

Between 1997 and 2014, a total of 47,597 primary HV operations were identified in Finland. The number of primary operations was 6267 (13.2%) in men and 41,330 (86.8%) in women. The total incidence of primary HV operations was 66.7 per 100,000 person-years in 1997 (2951 operations) and 41.4 per 100,000 person-years in 2014 (2012 operations). In men, the incidence was 10.1 per 100 000 person-years in 1997 and 6.2 per 100 000 person-years in 2014. In women, the corresponding figures were 64.9 per 100,000 person-years in 1997 and 38.3 per 100,000 person-years in 2014 (Fig. 1).

In patients aged 50–59 years, the incidence of primary HV operations decreased from 190.5 per 100,000 person-years in 1997 to 88.8 per 100,000 person-years in 2014 while in persons aged 40–49 years the incidence of primary HV operations decreased from 92.8 per 100,000 person-years in 1997 to 50.5 per 100 000 person-years in 2014. There was no marked change in patients aged 70 or older, the incidence being 11.4 per 100,000 person-years in 1997 and 10.3 per 100,000 person-years in 2014. In patients aged 60–69 years, the incidence of primary HV operations decreased from 123 per 100,000 person-years in 1997 to 84.4 per 100 000 person-years in 2014 (Fig. 2).

During the 18-year study period, MT-1 osteotomy was the most common primary operative procedure performed (n = 26,667; 62.1%) followed by MTP-1 arthroplasty (n = 8910; 20.8%), MTP-1 arthrodesis (n = 4527; 10.4%), TMT-1 arthrodesis (n = 1574; 3.7%), and other operation on bone of ankle or foot, including bunionectomy and cheilectomy (n = 1259, 2.9%).

The incidence of arthroplasty operations of the MTP-1 joint decreased from 30.9 per 100,000 person-years in 1997

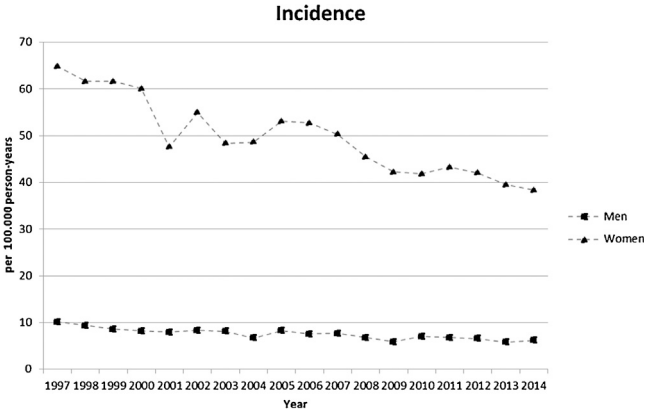

Fig. 1. Primary HV operations in Finland from 1997 to 2014.

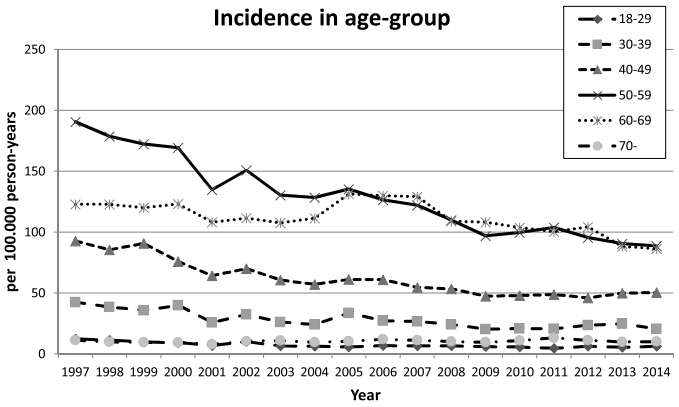

Fig. 2. Incidence of HV operation by age-group.

(n = 1369, 47%) to 1.8 per 100,000 person-years in 2014 (n = 86, 4%) while the incidence of MTP-1 joint arthrodesis increased from 1.3 per 100,000 person-years in 1997 (n = 56, 2%) to 14.9 per 100,000 person-years in 2014 (n = 725, 36%). Overall, the incidence of MT-1 osteotomy decreased from 32.1 per 100,000 person-years in 1997 (n = 1421, 48%) to 20.7 per 100,000 person-years (n = 1005, 50%) in 2014, but the proportion of MT-1 Osteotomies of all surgical procedures maintained between 1997 and 2014. Between 1997 and 2005 the proportion of MT-1 osteotomies increased from 48% to 73%, but decreased again to 50% in 2014. The incidence of TMT-1 joint arthrodesis increased from 0.2 per 100,000 person-years in 1997 (n = 7, 0.2%) to 3.1 per 100,000 person-years in 2014 (n = 149, 8%) (Fig. 3).

5. Discussion

This study is the first to describe the significant decreasing trend of HV operations in Finland between 1997 and 2014. To the best of our knowledge, there have been no previous studies that have covered nationwide trends in primary HV surgery. The unique data used in this study included the whole population of Finland, a total of 47,597 primary HV operations over a period of 18 years. This large number of patients provides a comprehensive sample of HV surgery. The gender distribution seen in our study (13% men, 87% women) is consistent with previous studies [27,35]. According to our results, it seems that during the last two decades the numbers of primary HV operations are decreasing, especially in persons aged 40–59 years. During the study period, the incidence of MTP-I joint arthroplasty decreased from being the second most popular procedure to the least used. Furthermore, the incidence of MT-1-osteotomies has almost halved since 2005. At the same time, the incidence of MTP-1 joint arthrodesis increased by over 1000% and TMT-1 joint arthrodesis by nearly 2000%. In 2014, the most common operative procedure to treat HV was MT-1 osteotomy (n = 1005, 50%), followed by MTP-1 joint arthrodesis (n = 725, 36%), and TMT-1 joint arthrodesis (n = 149, 8%).

The majority of HV patients were women. In women, the incidence was 64.9 per 100 000 person-years in 1997 and 38.3 per 100 000 person-years in 2014. The incidence of primary operation in men was 10.1 per 100 000 person-years in 1997 and 6.2 per 100 000 person-years in 2014. At the end of the study period, the mean age of the operatively treated HV patient was 58 years, and 86% of the patients were female. The female-male ratio of HV operation has also been confirmed in other studies [3,5]. The etiology of HV differs between men and women [35]. It has been previously suggested that HV is more often associated in women with lower BMI and high heels worn between the ages of 20 and 64. In men, HV is associated with higher BMI and pes planus [35].

In 2001 and 2003, Torkki et al. showed that the operative treatment of HV was cost-effective [9,20]. Interestingly, after 2001, the incidence of HV primary operations increased slightly and one explanation for this increase could be the evidence of cost-effectiveness provided by Torkki et al. However, a decrease in the incidence of HV operations began in 2005, especially in persons aged 40–59 years. This is an interesting finding because, in general, it had been thought those middle-aged individuals are more physically active than previously and would thus insist on more active treatment. On the other hand, a better understanding of foot biomechanics and the factors behind the pathogenesis of HV have provided better conservative means of treating mild deformities and ways for patients to better cope with the deformity. To date, however, there are no studies that support this claim. Moreover, there have been no studies that explain the overall decreasing trend in HV operations. Economical or insurance policy changes can hardly explain the decreasing trend seen in this study because the public health care system in Finland is free.

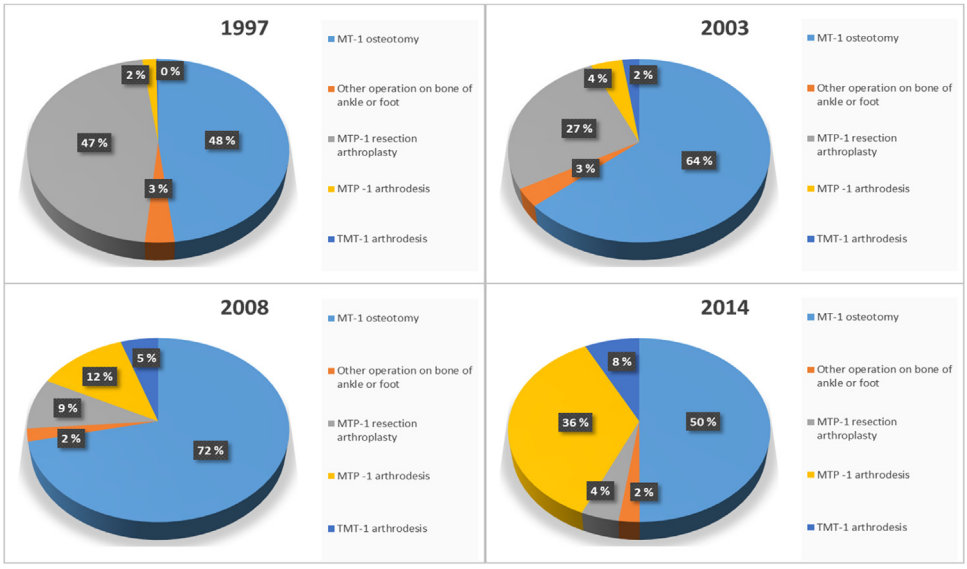

Fig. 3. Proportion of primary operation technique.

The most common procedure in our sample of 47,597 primary HV operations was MT-1 osteotomy. Despite the incidence of MT-1 osteotomy having nearly halved between 2005 and 2014, it was still the most used method to treat HV deformity in 2014. Ferrari et al. have suggested that first metatarsal operation (chevron osteotomy) is beneficial compared with orthoses or no treatment. However, when compared with other osteotomies, no technique was shown to be superior to any other [36,37]. One cohort study reported that 12.6% of patients had reoperation after Chevron osteotomy as correction for mild to moderate HV [37]. The literature shows the incidence of hallux varus varies from 2 to 17% after different types of hallux valgus operations [38–40]. The results of these studies prove that complications are quite common after HV surgery, and therefore surgical treatment should be carefully considered, especially in the treatment of asymptomatic or mild HV deformities.

The resection arthroplasty of first MTP joint procedure was nearly as common as MT-1 osteotomy in the late 1990s but has reduced remarkably ever since. In 2014, the resection arthroplasty accounted for only 4% of the surgical procedures of HV in Finland. Resection arthroplasty may be effective in pain relief, but it carries a high risk of postoperative metatarsalgia due to the instability and poor function of the first MTP joint [13,14]. This phenomenon can be explained by the complexity of the anatomy of the first MTP joint [4].

While the incidence of resection arthroplasty and osteotomies of MT-1 have decreased, fusion operations of the MTP-1 and TMT-1 joint have gained in popularity, especially after 2005. For severe HV, a first MTP joint arthrodesis is an excellent procedure for the correction of deformity and leads to a permanent and satisfactory cure and correct intermetatarsal (IMT) angle [23,41]. There are also, however, significant complications after MTP-1 arthrodesis. Chiodo et al. [42] showed that the overall incidence of radiographically confirmed nonunion after MTP-1 arthrodesis, regardless of the osteosynthesis technique, was 5.4%. The incidence of hardware removal was lowest for crossed compression screws (4.8%), essentially equal for dorsal plate and screws with or without oblique compression screws (8.1%) and orthogonal compression staples (10.9%), and the greatest for a single axial compression screw (13.3%) [42].

As recent studies have reported, the triplane deformity of the MT-1 is an important factor in more severe HV deformities, where this 'third plane of deformity' is the frontal plane deformity of the MT-1 [26,27]. Unlike most MT-1 head or shaft procedures, correctional arthrodesis of the TMT-I joint can address all three planes of the deformity [43]. The rotational stabilization of the TMT-1 joint improves the function of the windlass mechanism and enhances the weight bearing properties of the foot [44]. It is very probable that dedicated foot and ankle surgeons have started to prefer TMT1-arthrodesis over distal or shaft procedures to offer a more functional reconstruction of the foot and to prevent recurrences.

A limitation of our study is that the reoperations or bilateral operations to the same patient cannot be differentiated from the registry data. Therefore, only the first HV operation of each patient was included in the analysis, and thus resulted in a slight underestimation of the true incidence of HV operations. The most important strength of the current study is the accuracy and coverage of the obligatory Finnish NHDR which provided the data for the study. Furthermore, this is the first nationwide study that has assessed the incidence of HV surgery.

To date, there have been no studies that show that one technique is better than any other for HV surgery. This study has shown that the overall incidence of HV operation has decreased remarkably during the last two decades. It is not known, however, whether this decrease is due to an decreased incidence of the deformity itself, an increased awareness of the short- and long-term complications after HV operations, or the improved means of conservative treatment. This study has also shown that during the last two decades the popularity of resection arthroplasty of the first MTP joint in the treatment of HV has decreased. During the first decade of the study period there was an increase in the proportion of MT-1 osteotomies but after 2008 the proportion of MT-1 osteotomies decreased again. Towards the end of the study period the proportion of MTP-1 and TMT-1 arthrodesis increased in Finland, leading to a reduction in the proportion of MT-1 osteotomies. Overall, the proportion of MT-1 osteotomies maintained steady in this study period (from 48% in 1997 to 50% in 2014).

6. Conclusions

The overall incidence of HV surgery has decreased markedly in Finland between 1997 and 2014. This study shows that MT-1 osteotomy is the most common technique in the surgical treatment of HV, but there is an increasing trend to use MTP-1 and TMT-1 arthrodesis in the primary surgical treatment of HV.

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