

Interdigital Perineural Fibroma And A Care Pathway.

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Research

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Abstract

Background

Interdigital perineural fibroma (IPF) is a complex condition affecting the plantar nerve of the foot and the care pathway for its management is based upon a consensus of clinical opinions.

Aim

The aim of the study was to investigate the treatment outcomes within a podiatric surgical practice and produce a validated care pathway over a three-year period.

Methods

A retrospective mixed methods design was used to allow combination of quantitative and qualitative data. 89 patients between 1/4/2014 and 1/4/2017 had completed PASCUM-10 audit data. The treatment options were investigated and the MOXFQ domains and PSQ10 outcome scores were subject to analysis with SPSS.

Findings

The mean age of patients in the study was 56 (range 36-86, SD 10.85) and 89% were female, 11% male. 749 patients out of the total caseload had local anaesthetic/steroid injections over the three-year period, of which 49% of the known injections were for Morton's Neuroma. No outcome data was recorded for injections.

89 patients went forward for surgical excision of the IPF. The surgical approach for excision was either dorsal (60.7%) or plantar (39.3%). All plantar incisions (transverse and linear) were analysed as a group for comparison against the dorsal approach. Using an independent t-test, there was no significant difference for dorsal or plantar approach or location of IPF across the three MOXFQ domains and PSQ10.

Using a Pearson product moment correlation coefficient there was a moderately strong correlation between the PSQ10 and the MOXFQ domains (n=89, Walking and Standing: $r=0.48$, $p<0.01$; Pain: $r=0.42$, $p<0.01$; Social Interaction: $r=0.40$, $p<0.01$). Where increases in MOXFQ outcome score (amount of improvement) produces higher PSQ10 scores (greater patient satisfaction).

Conclusions

More audit data is required to assess the effectiveness of steroid and / or alcohol injections. Recommendation for practice is based on literature review. The surgical outcomes would suggest that the excision of IPF is an appropriate and effective technique and the surgical approach or location of pathology will not affect the clinical outcomes. A new care pathway for the management of IPF (Morton's Neuroma) will be employed in practice and

Introduction

Interdigital Perineural Fibroma (IPF) (Morton's Neuroma, Interdigital neuroma, Morton's metatarsalgia, nerve entrapment syndrome) is a complex condition affecting the common plantar and proper digital nerves of the foot. The first excision of an interdigital neuroma was by Hoadley in 1883 (1) or although it had been described previously by multiple authors (2). It can affect any of the interspaces or toes but is commonly described as affecting the third intermetatarsal space between the third and fourth metatarsals and to a lesser extent the second intermetatarsal space (3).

From the Clinical Knowledge Summaries, there are a variety of clinical pathways that patients can be followed, ranging from conservative care of footwear modification and injection of steroid or alcohol to surgical excision (4). This is likely to depend upon the clinician's experience and preferences which is determined by their training and clinical results rather than influenced by research findings. A comprehensive clinical pathway was provided by Thomas et al, 2009 (5), which provides a consensus of clinical opinions. It was then further developed into an Algorithm for Clinical Practice by Di Caprio et al, 2017 who recommend orthoses and steroid injections, followed by excision dorsally and potential revision via a plantar approach (6). They give an excellent foundation for comparison of the findings from this study.

Surgical excision of IPF can be undertaken from various dorsal or plantar incisions and the choice of approach for excision is debated by colleagues (7). The dorsal approach is claimed to offer adequate exposure to identify and excise the nerve and has relatively few complications. However, the critics suggested that the exposure and traceability of the nerve proximally is limited. The plantar approach offers better exposure and traceability of the nerve proximally, but this risks a painful scar or callus formation (8). The plantar approach can be transversely distal to the metatarsal phalangeal joints (MTPJ's) or linearly between the MTPJ's (9).

The purpose of this study is to evaluate the current service and outcomes provided within a busy Podiatric Surgical practice. The outcome of the study will be to produce an updated evidenced based care pathway for clinicians to review and adapt to their own practice. It will examine the current service provision and assess available research for conservative treatment. It will also examine the pre-and post-operative data and patient satisfaction to establish the overall outcomes for surgical intervention.

The construction of a structured care pathway is essential to provide a framework for effective care and the best possible outcomes for patients. It also helps to reduce potential litigation. The number of claims against NHS bodies in the UK rose by 66% between 2008–2013 and orthopaedics accounted for 49% of these claims (£490 Million) (10). The need to have validated care pathways is essential to help reduce this and meet the "Bolam test" for "acting in accordance with a practice accepted as proper by a responsible body" (11). It also helps support an informed consent process to give patients a rational and informed approach to care (12).

The injection technique used was a combination of 0.5% Chirocaine and 40 mg Depomedrone delivered under ultrasound guidance from a dorsal approach between the associated interspace (13). Chirocaine is used to give long-lasting analgesia to confirm the relief of symptoms.

Methods

The sample was based on the total number of patients presenting with US confirmed IPF over the 3 year period up to the 1st April 2017 (01/04/14 to 01/04/17) at a busy Consultant-led Podiatric Surgical Practice. There were no exclusions and data were drawn from the clinical records and outcome reports of PASCOM-10 (Podiatric Audit in Surgery and Clinical Outcome Measure) database from within the organisation only (14). Given the complexity of the foot and multiple pathologies, some patients did have had multiple procedures and have been included.

All patients had undergone and failed conservative treatment prior to surgery and was performed by one podiatric surgeon.

The hospital registration process also included a consent for the use of patient data for the purpose of audit. Approval for this service evaluation was gained from Huddersfield University research ethics panel and hospital management committee.

The anonymised patient data collected was from PASCOM-10 data for MOxFQ domain scores and PSQ10 scores and exported to an Excel spreadsheet for combination with other qualitative data fields and statistical analysis. The data was collected by an independent research assistant from face to face contacts, via email links, telephone consultation and postage depending on the patient's preference.

Embedded in to the current version of PASCOM-10 is The Manchester-Oxford Foot Questionnaire (MOxFQ) which utilises three domains to assess Patient Reported Outcome Measures (PROM) and was developed and validated for assessing outcomes following foot and/or ankle surgery (15). The three domains use 16 categories to assess Walking/Standing (7 items), Pain (5 items) and Social Interaction (4 items) and two of the domains (Walking/Standing and Pain) are consistent against Rasch measurement principles (16). The responses are measured against a 5-point Likert scale ranging from no limitation to maximum limitation and indicate unidimensional and equal interval scales (15). PASCOM-10 also uses a Patient Satisfaction Questionnaire (PSQ-10) to assess aspects of the quality of service delivery and patient satisfaction.

The MOxFQ has been through a thorough development process including a relevant patient group and comparison against a number of outcomes measurement tools (17), addressing the concerns raised by Parker et al 2003 and affirming its construct validity (18). However, the scores generated fall foul of the similar problems of most outcome tools in that the scores measure a change in pre-and post-treatment levels but do not express the end satisfaction or remaining disability. Considering that the MOxFQ produced a quantitative value of improvement and the PSQ-10 is a qualitative value for patient

satisfaction, together they form a synergistic relationship which gave a comprehensive measure of clinical outcome.

The independent-samples t-test was used to test the research hypothesis (alternative hypothesis) that:

1. The dorsal or plantar surgical approach affects the MOxFQ domains for walking and standing, pain and social interaction and the PSQ10,
2. The location of the pathology affects the MOxFQ domains for walking and standing, pain and social interaction and PSQ10,
3. Having additional surgery at the same time as the IPF excision affects the MOxFQ domain scores and the PSQ10.

The confidence interval was set at 95% ($p = 0.05$) with a two-tailed alternative hypothesis and that:

1. The data are quantitative and of normal distribution,
2. The sample data come from distributions that may differ in their mean,
3. The observations are independent of each other,
4. The sample is of sufficient size.

A priori calculation for required sample size was computed using G*Power 3.1 given a two-tailed t-test for independent samples, effect size (Cohen's d) 0.8, alpha 0.05, power 0.8 (80%) (19). This suggested a sample size of 52 was appropriate.

The Pearson product-moment correlation coefficient was used to test the research hypothesis (alternative hypothesis) that:

1. There is a correlation between the three MOxFQ domains and the PSQ10 score,
2. There is correlation between the PSQ10 score and the duration post-operatively (length of time from operation date to assessment in study).

The confidence interval was set at 95% ($p = 0.05$) and assumes that the data are of interval measurement. A priori calculation for required sample size was computed using G*Power 3.1 given a correlation (bivariate normal model) of, $p H1 = 0.3$, alpha 0.05, power 0.8 (80%). This suggested a sample size of 84 was appropriate.

Results

The results of the qualitative assessment of the service shows that there is little provision for the recording of data from injections. Between the study dates, there were a total of 749 ultrasound guided injections recorded (Fig. 1). 27% did not have the site recorded and almost half of the total were steroid injections for neuroma. There was no recording of any PASCOM-10 data and, therefore, the effectiveness of injections cannot be assessed. All patients had an ultrasound scan to confirm the diagnosis.

There were intermittent data recorded in the notes for orthosis or footwear advice, and no patients had cryotherapy or alcohol neuroablation.

From 1st April 2014 to 2017, 109 patients were referred for surgical excision of their IPF with complete data available for only 89 (82%) of patients. 79 (89%) of the patients were female with an average age of 56 years old (range, 36–86, SD 10.85). There were 56.2% of the patients with right sided pathology, 38.2% with a left sided pathology and 5.6% had an IPF on both feet. Of the surgical approaches, 54 (60.7%) were from the dorsum and 35 (39.3%) from a plantar approach. This was further broken down by plantar transverse 23 (25.8%), plantar linear 11 (12.4%) and one (1.1%) epineurolysis. For the purpose of analysis, all plantar incisions were considered as a group against dorsal.

Of the 89 patients, 22 (24.4%) had neuroma excised from the 2/3 and 3/4 interspaces of the same foot and all were plantar approaches.

The post-operative follow-up period was an average of 130 weeks (range 48 to 203).

Furthermore, of the 89 patients having an IPF excision, 53 (59%) had another procedure at the same time (Table 1). The most common procedures were a lesser toe fusion or 1st metatarsal osteotomy.

Table 1
Breakdown of Additional Surgery

PSQ10 Scores	Frequency(n)	Mean	Std Deviation	Min	Max
No Additional Surgery	53	91.15	7.55	69	100
Lesser Toe Surgery	23	85.52	14.66	44	100
1st Metatarsal Surgery	9	79.78	15.79	45	95
Other Surgery	4	93.50	5.07	89	100
TOTAL	89	88.65	11.24	44	100

MOxFQ Analysis

The MOxFQ scores obtained are given in Table 2 and show substantial changes from pre to post-operative across the three domains.

Table 2
Breakdown of MOxFQ Scores by Domain

	Frequency (n)	Min	Max	Mean	Std. Deviation
Pre WS	89	17	100	71.01	20.81
Post WS	89	0	100	20.39	25.83
Score WS	89	-17	100	50.62	25.13
Pre Pain	89	20	100	65.65	19.94
Post Pain	89	0	100	20.11	24.19
Score Pain	89	-10	95	45.54	22.56
Pre SI	89	0	100	51.97	25.75
Post SI	89	0	100	17.84	23.53
Score SI	89	-25	81	34.12	24.44

The MOxFQ domains and PSQ10 were subject to analysis for the operative approach and results are given in Table 3 and an independent-samples t-test was conducted to compare the operative approach against the MOxFQ domains and PSQ10 scores.

Table 3
Breakdown by Surgical Approach

Domain	Surgical Approach	Frequency (n)	Mean	Std. Deviation
Pre Walking & Standing	Dorsal	54	70.65	18.72
	Plantar	35	71.57	23.96
Post Walking & Standing	Dorsal	54	19.00	23.99
	Plantar	35	22.54	28.67
Pre Pain	Dorsal	54	66.76	18.30
	Plantar	35	63.94	22.40
Post Pain	Dorsal	54	18.89	22.49
	Plantar	35	22.00	26.90
Pre Social Interaction	Dorsal	54	54.20	24.89
	Plantar	35	48.51	27.02
Post Social Interaction	Dorsal	54	17.35	22.68
	Plantar	35	18.60	25.109
PSQ10	Dorsal	54	90.28	10.14
PSQ10	Plantar	35	86.14	12.49

Across all domains there was no significant difference:

Walking and standing, ($t(87) = 0.48$, $p = 0.634$, $CI = -8.27-13.51$) for dorsal ($M = 51.65$, $SD = 22.66$) and plantar ($M = 49.03$, $SD = 28.81$).

Pain. ($t(87) = 1.21$, $p = 0.23$, $CI = -3.78-15.63$) for dorsal ($M = 47.87$, $SD = 20.64$) and plantar ($M = 41.94$, $SD = 25.14$).

Social interaction, ($t(87) = 1.31$, $p = 0.19$, $CI = -3.56-17.44$) for dorsal ($M = 36.85$, $SD = 24.91$) and plantar ($M = 29.91$, $SD = 23.43$).

PSQ10 score, ($t(87) = 1.71$, $p = 0.09$, $CI = -0.66-8.93$) for dorsal ($M = 90.28$, $SD = 10.15$) and plantar ($M = 86.14$, $SD = 12.49$).

These results suggest that the surgical approach does not have an effect on the MOxFQ domains or patient satisfaction.

An independent-samples t-test was conducted to compare the location of the pathology to the MOxFQ domains:

Across all domains there was no significant difference:

Walking & Standing, ($t(87) = -0.29, p = 0.634, CI = -14.66-10.84$) and the site of surgery, 2/3 location ($M = 50.19, SD = 27.12$) and 3/4 location ($M = 52.10, SD = 17.02$).

Pain, ($t(87) = -1.87, p = 0.06, CI = -21.82-0.64$) and the site of surgery, 2/3 location ($M = 43.16, SD = 23.41$) and 3/4 location ($M = 53.75, SD = 17.46$).

Social interaction, ($t(87) = -0.51, p = 0.61, CI = -15.58-9.19$) and the site of surgery, 2/3 location ($M = 33.41, SD = 24.83$) and 3/4 location ($M = 36.60, SD = 23.49$).

An independent-samples t-test was conducted to compare the PSQ10 score against neuroma excision with concomitant procedures. There was a significant difference in the scores for no additional surgery ($M = 91.15, SD = 7.55$) and additional surgery ($M = 84.97, SD = 14.48$) conditions; $t(87) = 2.63, p = 0.01$ ($CI = 1.51-10.85$). These results suggest that the additional surgery at the time of neuroma excision produces a lower PSQ10 score.

PSQ10 Analysis

The PSQ10 (patient satisfaction) scores were a skewed distribution (Fig. 2) such that the mean score was 88.65 (std dev = 11.24, $n = 89$) with a minimum 44 and maximum 100.

A Pearson product-moment correlation coefficient was computed to assess the PSQ10 score:

There was a significant relationship with MOxFQ walking and standing domain. There was a positive correlation between the two variables, $r = 0.48, n = 89, p < 0.01$. Overall, there was a relatively strong, positive correlation between the walking and standing score and the PSQ10. Increases in the outcome score for walking and standing were correlated with increases the PSQ10 score.

There was a significant relationship with the MOxFQ pain domain. There was a positive correlation between the two variables, $r = 0.42, n = 89, p < 0.01$. Overall, there was a relatively strong, positive correlation between the pain score and the PSQ10. An increase in the outcome score for pain were correlated with increases the PSQ10 score.

There was a significant relationship with the MOxFQ Social Interaction domain. There was a positive correlation between the two variables, $r = 0.40, n = 89, p < 0.01$. Overall, there was a relatively strong, positive correlation between the social interaction score and the PSQ10. Increases in the outcome score for social interaction were correlated with increases the PSQ10.

There was a no correlation for the duration from the operation date, $r = 0.09, n = 89, p = 0.42$.

The study data was also compared to comparative national data obtained from PASCOM 10 database over the same three-year period (20). The results show comparative findings with marginal improvement in study scores against the national data (Table 4).

Table 4
Comparison of Study Outcomes to National Data

National Data	Study Data							
	Pre-op n = 1295		Post op n = 1293		Pre-op n = 89		Post op n = 89	
Domain	Mean	Std dev	Mean	Std dev	Mean	Std dev	Ave	Std dev
Walking & Standing	65.24	20.77	21.45	25.59	71.01	20.81	20.39	25.83
Change score			43.79				50.62	
Pain	62.50	17.97	24.88	23.65	65.65	19.94	20.11	24.19
Change score			37.62				45.54	
Social Interaction	50.28	23.56	16.44	22.15	51.97	25.75	17.84	23.53
Change score			33.84				34.13	
PSQ10			86.39	13.57			88.65	11.24

The study is subject to potential bias from patients responding to the questions in an attempt to please the clinician and possible dissatisfaction with other foot surgery and not specifically the IPF operation. The questionnaire may also produce systematic errors by encouraging answers over others and in some cases to recall bias. An independent research assistant was used to help negate these issues.

The format for the study was a retrospective mixed methods design which allows the assessment of “an unknown or complicated topic” (21). This allows the combination of both quantitative and qualitative data to obtain a better understanding of the service and the outcome measures. This “concurrent triangulation” method therefore, is used to confirm or cross-validate the findings from both methods of the data collection (22).

Discussion

Of the potential 109 participants for the study, 89 had completed data fields and were included which represents an 82% completion rate, and an acceptable and comparable sample size for the study. The demographic profile of the study group is consistent with the reported demographics for age and gender in the literature: IPF does appear to be prevalent across a wide age range and is more common in females (5). This gives the study favourable external validity.

The current audit data collection process by the hospital for injection therapy is deficient and does not record patient outcome measures despite this service being widely used with 749 injections over the three years of the study. The injections for IPF were also limited to single steroid or occasional sequential steroid injections. Whilst these are a recommended treatment for IPF, the extent and quality of audit data for non-surgical management of IPF is variable and at times contradictory (23). However, given the

evidence in the literature search, it would be reasonable to include steroid injections into the pathway given that they may not be a long-term effective treatment but can also act as a diagnostic tool.

The literature also suggests that alcohol neuroablation injections produce satisfactory results in 89% of cases but the current care pathways do not advocate its use, and this may be due to the mixing of drugs, or concerns over the long-term effectiveness of the technique (24). The longevity of the technique has been criticised by Gurdezi, White, & Ramesh, 2013 but further researchers, Pasquali, et al., 2015, have disagreed with the findings and, therefore, the technique warrants inclusion in a care pathway, following the clinical technique and recommendations of Dockery, 1999 (24) (25) (26).

Other conservative or non-surgical options are offered by the local triage service and, at this time, the effectiveness of the treatments have a limited evidence base and require further investigation. Therefore, they have not been considered for inclusion in the secondary care pathway but are likely to be undertaken by Triage service prior to secondary referral. Moreover, the use of “generic anti-pronatory” insoles does not reflect the complexity of foot biomechanics and investigation into outcomes and patient satisfaction with bespoke orthosis (insoles) would be valuable in the formulation of a care pathway.

The use of ultrasound has its detractors but there is good evidence to suggest that guided injections are advantageous, and it would seem logical that a technique that allows the accurate visualisation of the placement of a drug into a tissue is beneficial (27) (28). This would also negate the risk of potential litigation and is primarily supported by advisory bodies (29).

The size of the IPF has been suggested as a possible factor in clinical outcomes for conservative care but this was not examined in this study. However, this data is available and a further study comparing the functional outcomes of surgery and patient satisfaction with the size of the IPF may provide constructive data for further development of the care pathway. If it assumed that the size of the IPF lesion is proportional to the duration of the condition then the timing of the surgery, and size of the lesion, may influence the potential outcomes.

The study also shows that the prevalence for IPF was more common in the 2/3 (77.5%) than the 3/4 intermetatarsal space (22.5%) and disagrees with previous literature (3). It also shows IPF to be prevalent in both spaces in 24% of patients in comparison to the 12% reported by Kasperek & Schneider, 2013, which is likely due to the high incidence of IPF in the 2/3 space (30). This may be attributed to the use of Ultrasound scans to support the clinical diagnosis and may represent an over diagnosis. However, diagnosis was also supported by isolated local anaesthetic and steroid injections before progressing to surgery, and a further study into the incidence and location of the pathology is suggested.

Again, in contrast to Kasperek & Schneider, 2013, the outcomes for double IPF excision were not significantly different to single IPF excision. There was also no significant difference in the post-operative follow-up duration and the patient satisfaction with the surgical outcomes (PSQ10), which is contrary to the findings of Lee et al, 2011 who suggests that the long-term results are not as favourable as the short term (31). This would suggest that the surgical technique employed in the study was effective at

removing the IPF, and there were limited complications or regrowth of the lesions, for the majority of the patients, at an average of 130 weeks (range 48–203 weeks). Unfortunately, it is not possible to directly assess the individual surgical techniques of clinicians and this is likely to lead to some variance in outcomes.

In this study, the range and type of post-operative complications was not examined and no comparison can be drawn directly to the literature. However, if the PSQ10 is considered as a measure of patient satisfaction, then a score below 60 would represent a poor outcome. This was seen in 3 patients (3.3%), although it is not known if they underwent revision surgery. However, if the level of “acceptable satisfaction” is set at a PSQ10 of 70 then this figure rises to 7 (7.8%). These figures compare very favourably with the complication rate given in the literature, but this study does not identify the type of complications or reason for dissatisfaction. This may be a criticism of the study, but the extent of data collection required would have been prohibitive.

The MOxFQ domains results are not often reported in the literature but Flanagan & Reilly, 2016, do give the mean scores for the plantar incision approach on 42 patients (2). The scores obtained in this study are comparative pre-operatively and very slightly lower post-operatively to their study. When the MOxFQ domains in this study are analysed further to assess the effect of surgical approach (dorsal or plantar), there was no significant difference across the three domains and this agrees with the findings of Akermark et, 2008, although they did not present MOxFQ scores (7). There was also no significant difference between the site of the pathology (2/3 or 3/4) and the MOxFQ domain scores. Therefore, the care pathway cannot directly recommend which surgical approach is best and this would be based on the clinician’s preference.

In contrast, there was a significant difference in the patient satisfaction (PSQ10), with a lower outcome score associated with additional surgery, at the time of IPF excision. However, the MOxFQ scores were not significant for additional surgery. Unfortunately, the study was not able to differentiate if the lower satisfaction score was associated with the IPF excision, the additional surgery or a combination. It may be difficult for patients to appreciate the study requirements to answer questions directly related to the IPF only and not to other aspects of their surgery, which may have been more extensive. Furthermore, it may be that the few data outliers may be causing a skewing of the results, and therefore, there may be no significant difference with a larger sample. However, the care pathway could recommend that the excision of IPF with additional foot surgery may contribute to lower satisfaction levels but not functional scores. It is also suggested that further study into the outcomes of IPF excision with additional surgery against the outcomes from IPF excision only, at a National level, would be informative to the care pathway development in the future.

The MOxFQ and PSQ10 study data was compared to the National PASCOM reported outcomes (n = 1294) and there is marginal difference across all domains. In general, the patients in this study reported higher pre-operative and lower post-operative scores, indicating that the validity of this study data is supported against much larger numbers, and that the clinical technique is comparable to National standards. The

National data was not investigated further to establish the number of dorsal or plantar incisions. Furthermore, this study reported a marginal increase in PSQ10 indicating that there was a slightly higher patient satisfaction in this study.

The relationship between the functional assessment scores of MOxFQ domains and the patient satisfaction score of PSQ10 shows that there is significant correlation between the two scores, so that a greater change in the MOxFQ outcome score (improved function) produces a higher patient satisfaction rate. This would also seem a logical correlation that the post-operative function and patient satisfaction are directly linked and helps validate the MOxFQ and the PSQ10.

The clinical care pathway developed in Fig. 3 is an adapted version from Thomas, et al., 2009, with the addition of relevant research findings to guide clinicians or patients in treatment choice (5). The yellow boxes show clinical history findings and the orange box gives the test recommendations. The green box shows the recommended treatments and the red box shows the differential diagnosis for IPF. The recommendation for an initial dorsal surgical approach was based on the research evidence and results of the study. However, this can be varied based on clinician's personal preference and training.

The new clinical pathway (Fig. 3) compares well to the pathway suggested by Di Caprio et al, 2017 (6). However, their pathway reports inferior outcomes to those seen in this study: with lower success rates and a higher rate of unsatisfactory outcomes.

Conclusion

In conclusion, within PASCUM-10 both the MOxFQ and the PSQ10 are validated patient reported outcome measures and this study supports the use of PASCUM-10 as a national audit tool. Furthermore, the use of PASCUM-10 to help in the formulation of a care pathway is warranted. It is also suggested that the data collected for PASCUM-10 is used to help develop more clinical pathways.

However, this study has highlighted that the level of non-surgical care in this facility is limited to steroid injections and further treatment options should be employed. Further audit data is required to assess the effectiveness of non-surgical treatments and an audit system will be implemented into clinical practice as part of the audit review.

Alcohol neuroablation is recommended for non-surgical treatments. An application for the inclusion of ultrasound guided alcohol injections will be made to the Hospital Management and Medical Advisory Committee for inclusion into the care pathway.

The surgical outcomes of this study would suggest that the excision of IPF is an appropriate and effective technique and that the surgical approach or location of the pathology will not affect the clinical outcomes or patient satisfaction.

The principle aim of the study was to produce a specific care pathway (Fig. 3) for the management of IPF which is corroborated against research and current practice results. This care pathway will be

implemented into clinical practice and presented to healthcare professionals for discussion and use in general practice.

List Of Abbreviations

IPF:

Interdigital perineural fibroma / Morton's neuroma

MOxFQ:

The Manchester-Oxford Foot Questionnaire is a 16-item Patient Reported Outcome (PRO) measures developed and validated for use in clinical trials.

PASCOM-10:

Podiatric Audit of Surgical & Clinical Outcome Measures. A software system for collecting patient clinical audit data.

PSQ10:

A Patient Satisfaction Questionnaire used in the PASCOM system.

SI:

Social Interaction

SPSS Software:

Statistical Package for the Social Science

VAS:

A visual Analogue Scale is a response scale which can be used in questionnaires to measure the severity of symptoms.

WS:

Walking & standing

Declarations

Ethics approval was gained from the Hospital management and by the University of Huddersfield School of Human and Health Sciences – School Research Ethics Panel.

Consent for publication was not required as no individual data is given. However, all patients did consent to participate in the study.

Availability of data. The data contains information that may identify individuals and has not been made publicly available.

Affiliations:

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Conflict of Interest:

No conflicts to declare.

Author's Contributions.

MP undertook the study, analysed the data and wrote the study. AB was the supervising tutor.

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LEVEL OF EVIDENCE:

Level 2

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Figures

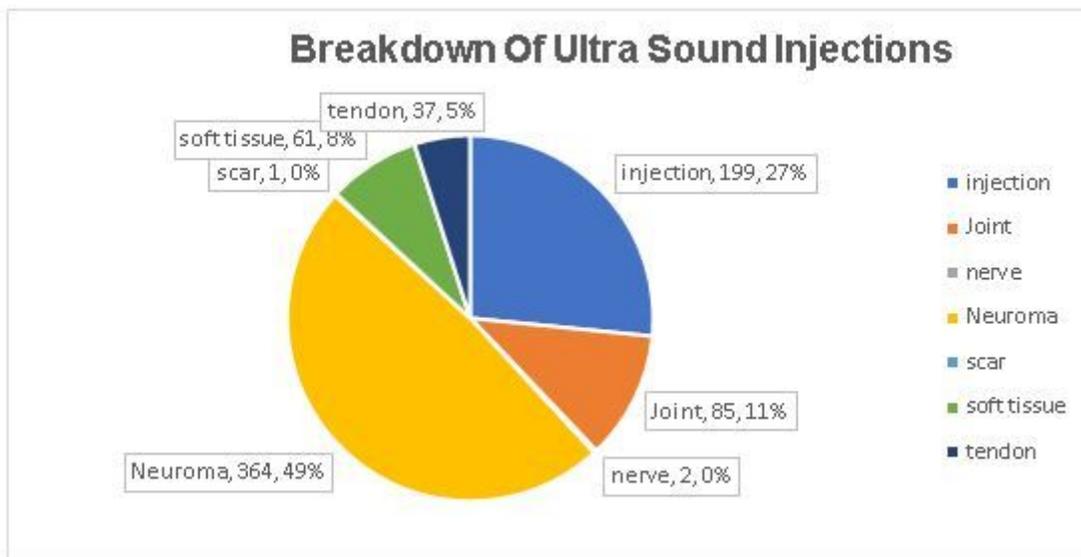


Figure 1

Breakdown of Injections

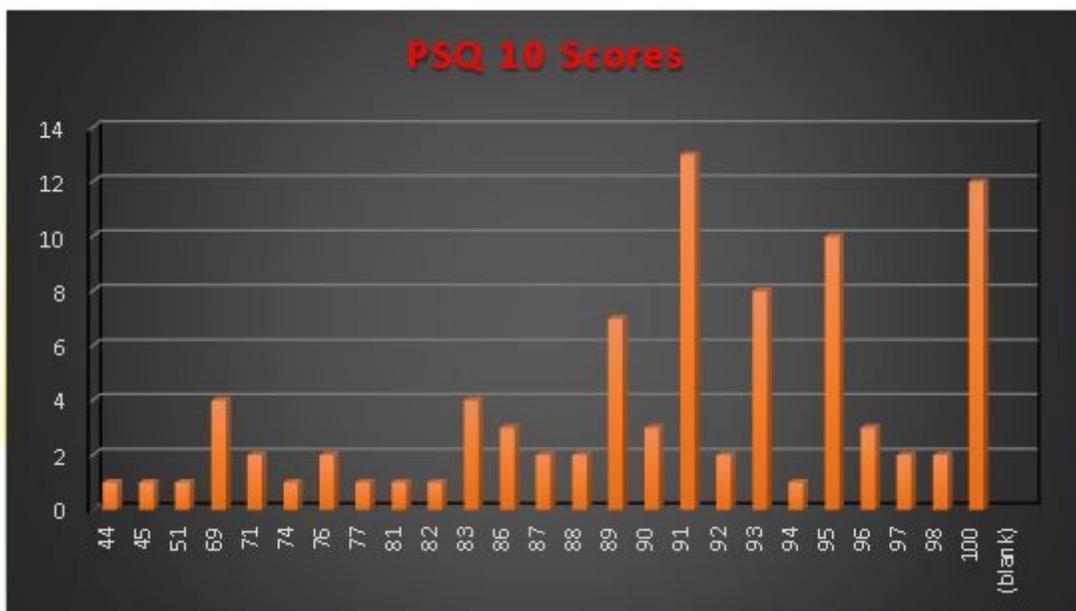


Figure 2

PSQ10 Scores

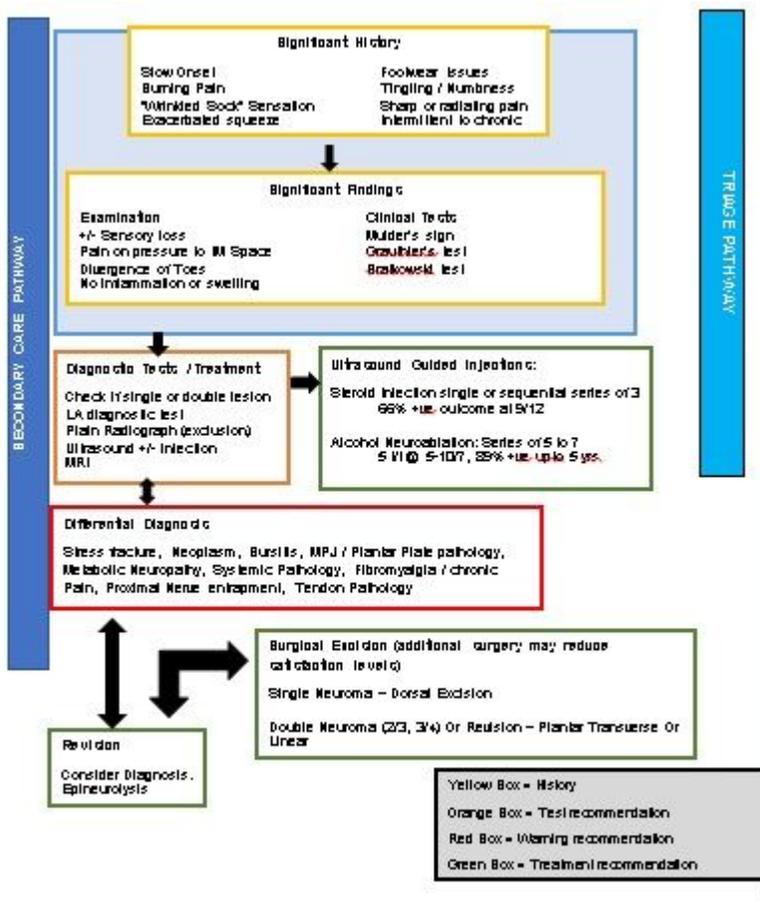


Figure 3

Secondary Clinical Care Pathway For Morton's Neuroma (adapted from Thomas et al, 2009)

Needle

Neuroma

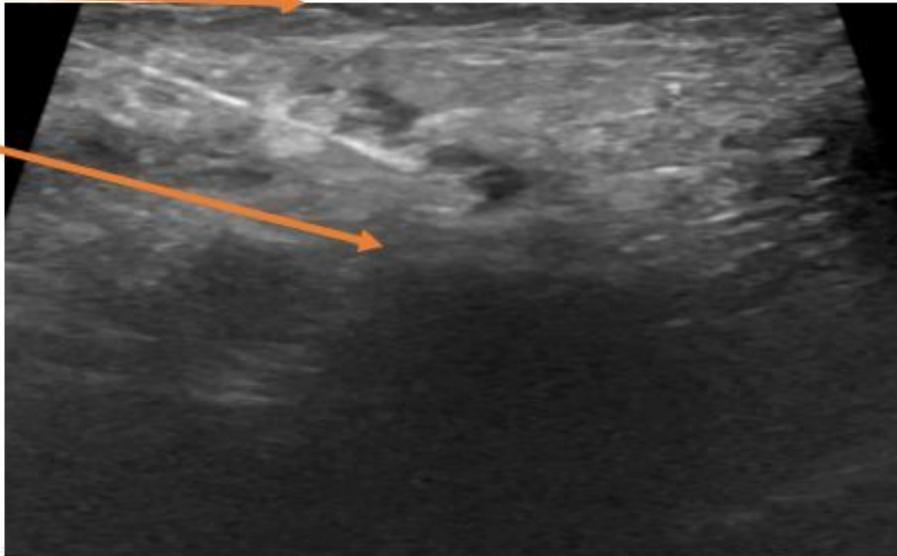


Figure 4

Needle approaching neuroma