Original Article

HEEL PAIN AND ITS ASSOCIATIONS

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Objective: Heel pain is an everyday increasing problem in young people more commonly in females. It is estimated that about one million people with complaint of heel pain seek medical advice per year. Therefore, it was needed to highlight its clinical associations.

Methods: One hundred and thirty-eight cases with heel pain were registered. For comparison, 134 subjects were registered as control. All subjects were segregated into gender groups. Each gender group was further subdivided into young (age < 40) and old (age > 40) groups. Three parameters were considered, i) blood pressure, ii) body mass index (BMI) and iii) serum uric acid level.

Results: The overall male to female ratio was 1:3. There was significant difference ($p < .05$) in the means of systolic and diastolic blood pressure of old (> 40) cases of both gender groups. The Odds ratio showed association between DBP and heel pain in female group only. There was significant difference ($p < .05$) in the means of BMI of cases from those of age and gender matched controls. The Odds ratios also showed strong association between increased BMI and heel pain. There was significant difference ($p < .05$) in the means of uric acid levels of cases from those of controls in female groups only. Similarly, the Odds ratio in this group showed association between hyperuricemia and heel pain. When above parameters were analysed for anindependentrisk factor, increased BMI and hyperuricemia were found to be associated with heel pain as isolated and independent risk factors.

Conclusion: In our study, the female cases outnumbered the male cases by 1:3.The results showing the association between heel pain and increased BMI were well consistent with the international studies. For hyperuricemia, the association with heel pain was also consistent with international studies. Similarly, the hypertension was also found in the cases with heel pain in old groups only. The obesity and hyperuricemia were found to beisolated and independent risk factors associated with the heel pain.

Keywords: Heel pain, BMI, Hyperuricemia, Hypertension.

Introduction

Heel pain is defined as pain at the bottom of heel and/or at the site of insertion of Achilles tendon, worsening on walking after rest or prolonged sitting.1 Planter fascists and heel spurs are the most common pathological causes of heel pain.[1,2] It is an everyday increasing medical problem commonly seen in young females. In a study in the USA, it was estimated that about one million people with heel pain (planter fascists) visit hospitals per year.[3]There are many factors associated with heel pain such as congenital deformities, excessive running, chronic arthritis, pronated gait, ill-fitting footwear, etc. Certain medical conditions are also attributed as risk factors with heel pain; these include obesity, hyperuricemia and hypertension.[4,5] Therefore, in this study, three risk factors, body mass index, serum uric acid level and blood pressure were included. These parameters in cases with heel pain were compared with those of the age and gender matched controls.

Methods

It was a case-control study. The cases were selected solely upon clinical basis; fulfilling the above definition of heel pain. The subjects with congenital deformities of foot, diabetes mellitus and with acute or chronic arthropathy were excluded from the study. There was no age or gender restriction. Any subject fulfilling the above definition criteria was included in the study. All cases and controls were segregated into male and female groups. Each gender group was then further divided into two subgroups, *i.e.,* young group, age less than 40 years and old group, age more than 40 years. All subjects were selected at the Out-door Patient Department, Sheikh Zayed Medical College Hospital, Rahim Yar Khan from 22-09-2015 to 16-05-2016. Five parameters were recorded in all subjects in the study. These were age, gender, blood pressure, body mass Index and serum uric acid. Blood pressure was taken with mercury sphygmomanometer. The upper limit of systolic blood pressure ≤ 140 mmHg and that of diastolic

pressure ≤ 90 mmHg was taken as normal. Weight and height were recorded on standard weight and height machine. Weight was recorded in kilograms nearest to the whole digit in ordinary clothes and height in centimetres nearest to 0.5 without shoes and DUPTA/CHADAR. The body mass index was computed using Quetelet ratio, weight (Kg)/height (meter)^2. Queteletratio 20-25 was taken as normal in both genders.[6,7] Serum uric acid of all subjects was assayed incomputerised Serum Analyser Machine. Normal upper limit of serum uric acid was ≤ 7 mg/dL in males and that of ≤ 6mg/dL in females. For statistics, the 'p' value was calculated using t-distribution using 95% confidence interval. The association with the risk factors was established using Odds ratio. The confidence interval for Odds ratio was calculated at the level of 95%. The Odd ratio or confidence interval containing 1.0 or zero was considered as "no association" between the heel pain and the parameter under consideration.

Results

Total 272 subjects were finally selected in the study. Among these, 138 subjects were cases and 134 were controls. The distribution of cases and controls in gender and age groups is summarised in the **(Table-1).** The above results showed that prevalence of heel pain in females was higher as compared to age matched males.

(Table-2**).** In young age groups, more females (1:4) were involved with heel pain as compared to old female group (1:1.5). The overall male to female ratio was found to be 1:3.

(Table-3). It is evident that there was no statistical difference in means of ages of cases and controls in both gender groups. The statistics of blood pressure revealed that the means of blood pressure were significantly higher in cases than those of controls in old groups (age > 40) of both genders. For body mass index, the means in cases were significantly higher than those of controls in all age and gender matched groups. The means of uric acid levels in female cases (both young and old groups) were significantly higher than those of age and gender matched controls. While, in both young and old groups of male cases, the means of the serum uric acid levels were statistically insignificant from those of age matched controls. **(Table-4).**

The Odds ratios of BMI in both gender groups revealed that the risk factor wass trongly associated with heel pain. This result was well consistent with that of found in the t-distribution ($p < .05$, in all age and gender groups). For hypertension, the Odds ratioshowed relationship between diastolic blood pressure and heel pain in females only. In males, no association was found between blood pressure and heel pain. While, the results of t-distribution revealed significant difference ($p < .05$) in the means of blood pressure in old male and female groups. For serum uric acid levels, the Odds showed strong association with heel pain in females only. The Odds ratio in males showed no relationship with heel pain. This is well consistent with the result of t-distribution that showed the significant difference in means of uric acid in female cases of young and old age groups from those of age matched controls($p < .05$). While, in males, the results of uric acid were insignificant($p > .05$)in both age groups.

The parameters under consideration, i.e., hypertension, obesity and hyperuricemia were analysed for an isolated and independent risk factor associated with the heel pain using Odds ratio. The combined (all subjects) data analysis revealed that obesity was associated as an isolated and independent risk factor with the heel pain, (OR 5.02; 95% CI = 2.78 9.05). The hyperuricemia was also associated as an isolated and independent risk factor with the heel pain (OR 2.19; 95% CI = 0.051 9.41). While, the Odds ratio evaluation for blood pressure as an isolated and independent risk factor for heel pain revealed nil results.

Discussion

In this study, the overall male-to-female ratio was 1:3. In a study in the USA, this ratio was found to be 1:2.[3] In another study in the USA, the females had

Table-1: Distribution of cases and controls in gender, age groups.

	Age<40		Age>40		Total		Grand Total
Gender	Cases	Controls	Cases	Controls	Cases	Controls	
Females	69	68	33	33	102	101	203
Males	16	16	20	17	36	33	69
Grand Total	85	84	53	50	138	143	272

Table-2: Summary of cases.(Male-to-Female Ratios)

Age	Males	Females	Grand Total	M:F Ratios
Age<40	16	69	85	1:4
Age>40	20	33	53	1:1.5
Grand Total	36	102	138	1:3

Table-3: The results of t-distribution.

Parameters	Females		Males	
Age	Age< 40 p>0.05 insignificant	Age< 40 p>0.05 insignificant	Age< 40 p>0.05 insignificant	Age>40 p>0.05 insignificant
Systolic BP	p>0.05 insignificant	P<0.05 significant	p>0.05 insignificant	p<0.05 significant
Diastolic BP	p>0.05 insignificant	P<0.05 significant	p>0.05 insignificant	p<0.05 significant
BMI	P<0.05 significant	p<0.05 significant	P<0.05 significant	p<0.05 significant
Uric Acid	P<0.05 significant	P<0.05 significant	p>0.05 insignificant	p>0.05 insignificant

Table-4: Results of Odds ratio.

Parameters	Females			Males		
Systolic BP	OR=0	AD/BC= 0	No association	OR=0	AD/BC= 0	No association
Diastolic BP	OR=6.60	CI=2.02 - 21.50	Associated RF	OR=0	AD/BC= 0	No association
BMI	OR=8.62	CI=4.20 - 17.67	*Associated RF	OR=6.93	CI=2.41 - 19.98	*Associated RF
Uric Acid	OR=11.76	CI=3.44 - 40.24	*Associated RF	OR=5.17	CI=1.03 - 26.02	*Associated RF

increased rate of incidence than males OR 1.95 (95% CI = 1.93-1.98).[8] In our study, the male-to-female ratio was increased most probably because of the fact that in female cases three risk factors were Bprevailing,*i.e.,* hypertension, increased BMI and hyperuricemia in comparison to male where only one risk factor,*i.e.,* increased BMI was found **[Table 3c].**

The means of the BMI of cases of both young and old age groups of males and females had significant difference ($p < .05$) from those of age and gender matched controls. Similarly, the results of Odds ratio also showed strong relationship between increased BMI and heel pain in both gender groups. In our study, the Odds ratio in males was 6.93 (95% CI = 2.41 19.98); and for females it was 8.62 (95% CI = 4.20 17.67). The statistical analysis also showed that increased BMI was an isolated and independent risk factor for heel pain. The results were similar to a study carried out in the USA where the Odds ratio in subjects with heel pain having BMI > 30 was 5.6 (95% CI = 1.9 16.6; $P < .05$).[8] In another study carried out in Netherland, the Odds ratio in subjects with heel pain having raised BMI (> 27) was 3.7 (95% CI = 2.93 5.62).[9] In another study by David M Pizzano, showed that 40% of obese, 23.4% of overweight and 11.4% of normal weight subject had heel pain.[10] In another study in the USA, study concluded a moderate correlation between increased BMI and planter fascia thickness.[11] Thus, the results regarding BMI in this study were well comparable with those of international studies.

The means of serum uric acid levels in young and oldfemale age groups with heel pain had significant difference ($p < .05$) from those of age matched controls. Similarly, the Odds ratio also showed strong association (OR 11.76; 95% CI = 3.44- 40.24) between hyperuricemia and heel pain in this gender group. The statistical analysis also showed that hyperuricemia was an isolated and independent risk factor for heel pain. In a study by Taniguchi Y, revealed that uric acid crystals were found from the aspirates of heel enthesitis.[12] In another article by Christian Nordqvist, higher levels of uric acid were associated with heel pain.[13]The attacks of acute gouty arthritis occur in joints of various locations including heels.[14] So, our results were consistent with the international researches. But, in 5.17; 95% CI = 1.03 26.02). Thus, in our study, there was disparity in results of male and female cases with regards to hyperuricemia. This parity can be explained on the fact that in female cases, hypertension (DBP) was associated with the heel pain. While in male cases, hypertension did not show any association with heel

pain (see below). It is fact that hypertension itself has strong associated with hyperuricemia.[15] In our study, the Odds ratio in female cases, showed strong association between high blood pressure (DBP) and hyperuricemia while in male cases, the same did not show such association. Therefore, hypertension could be a contributory factor of hyperuricemia in female cases.

Male cases of both age groups, the means of serum uric acid levels had insignificant difference ($p > .05$) from those of age matched control groups. Similarly, the Odds ratio did not show any association between hyperuricemia and heel pain in male cases as the confidence interval contained 1.0 (OR 5.17; 95% CI = 1.03 26.02). Thus, in our study, there was disparity in results of male and female cases with regards to hyperuricemia. This parity can be explained on the fact that in female cases, hypertension (DBP) was associated with the heel pain. While in male cases, hypertension did not show any association with heel pain (see below). It is fact that hypertension itself has strong associated with hyperuricemia.[15] In our study, the Odds ratio in female cases, showed strong association between high blood pressure (DBP) and hyperuricemia while in male cases, the same did not show such association. Therefore, hypertension could be a contributory factor of hyperuricemia in female cases.

For hypertension, there was significant difference ($p < .05$) in the means of blood pressure in cases of old age groups of both gender groups from those of age and gender matched controls. For Odds ratios, the female gender group with heel pain showed strong association with high diastolic pressure (OR 6.60; 95% CI=2.02-21.58). While in male groups, the Odds ratio was found to be zero. This disparity can be explained on the facts that in female cases there were three risk factors found, *i.e.,* increased BMI, hyperuricemia and high blood pressure. While, in male cases of both young and old groups, only one risk factor *i.e.,* increased BMI was found to be strongly associated with heel pain. This is another reason that number of female cases was three times of the male cases. As the high blood pressure had been found in both the old groups of male and female cases, most probably it could be age related. But it is fact that hypertension and hyperuricemia are inter-linked.[16]

Conclusion

In our study, increased BMI found to be the strong risk factor for heel pain in all age and gender groups of cases. In female cases of both young and old age groups, all three parameters, increased BMI, hyperuricemia, and hypertension were found to be associated with heel pain. The cases of old male group showed the relationship between hypertension and heel pain. The statistical analysis of combined data of all subjects revealed that increased BMI and hyperuricemia were isolated and independent risk factors for heel pain.

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References

01. Catherine Mover. DPM, "Heel Pain-An overview of causes and Treatment, nine causes of heel pain",http://www.verywell.com /heelpain-causes-treatment 1337747; updated June 17, 2016.
02. Jonathan Cluett. MD, "Five Common Causes of Heel Pain", http://www.verywell.com/heel pain-causes-treatment 1337747; updated June 17, 2016.
03. Craig C Young, "Planter Fasciitis", Medscape references, updated Oct 11, 2015.
04. Joseph J. Biundo, "Brusitis, tendinitis, and other Periarticular Disorders and Sport Medicine, Goldman's Cecil Medicine", 24th edition, 1681.
05. Issaquah Foot and Ankle Specialist, www.bestfootdoc.com/blong/hee l-pain-causes-what-cause-heel-pain-cfm
06. Robert B Baron MD, MS, Nutritional Disorders", Current Medical Diagnosis and Treatment 2016, 1250.
07. Heelspur.com/, "Planter Fasciitis and heel spurs," /intro2. html
08. Capt. Danielle L. Scher, MD, Lt. Col. Philip J. Belmont Jr. MD, "The Epidemiology of Planter Fasciitis",http://lermagazine.co m/article/the-epidemiology-of-planter-fasciitis, April 2010.
09. K D B van Leeuwen, J. Rogers, T Winzenberg, Dr. M van Middelkoop, "Higher body mass index is associated with planter fasciopathy/planter fasciitis' :systemic review and meta-analysis of various clinical and imaging risk factors,"British Journal of Sports Medicine doi:10.1136/bjsports-2015-094695.
10. Dr. David M Pizzano, "The Relationship between Obesity and Foot Pain," Roxbury Mail * 66 Town Centre * Suite405 * Succasunna NJ 07876.
11. Javier Pascual Huerta, Juan Maria Alarcon Garcia, Eva Cosin Matamoros, Julia Cosin Matamoros, and Teresa Diaz Martinez (2008), "Relationship

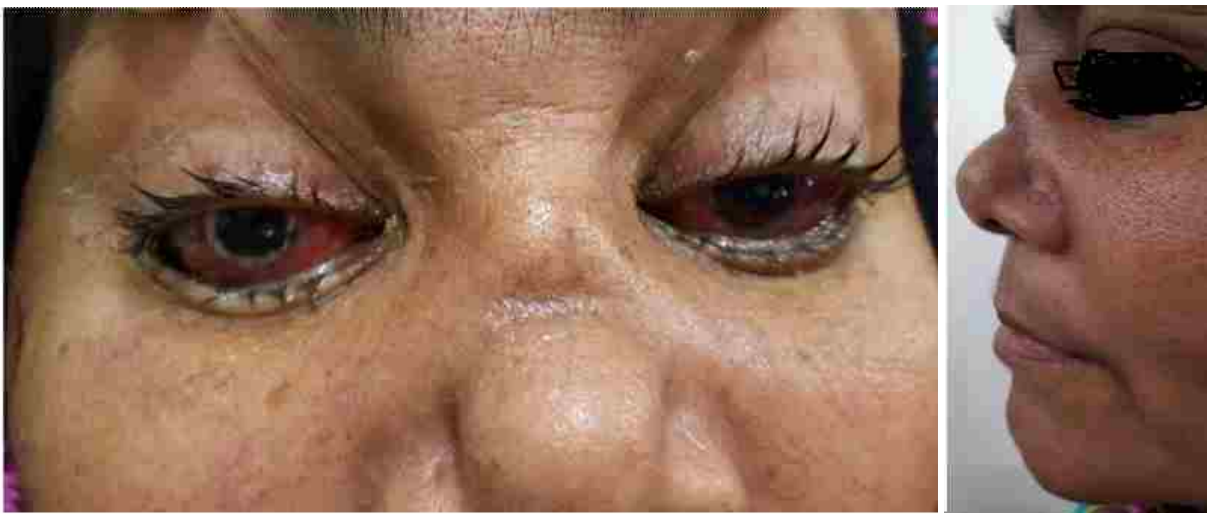
of Body Mass Index, Ankle Dorsiflexion, and Foot Pronation on Planter Fascia Thickness in Healthy. Asymptomatic Subjects," Journal of the American Podiatric Association, September 2008, vol.98, no. 5 pp.379-385.

12. Taniguchi Y, Matsumoto T, Tsugita M, Fujimoto S, Terada Y, "Spondylodiscitis and Achilles Tendinitis due to gout," Mod Rheumatol, 2014 Nov;24(6);1026-7. doi:10.3109/14397595.2013.877326.Epub 2014 Feb 5, PubMed.com
13. MLA, Nordqvist, Christian, "Heel Pain: Cause, Prevention, and Treatment," Medical News Today, MediLexicon, Intl., 24 December 2015, MNT article: http://www.medicalnewstoday.com/articles/181453.php
14. Andrew Harvai, "Bones, Joints, and Soft Tissue Tumors," Robins & Cotran Pathologic Basis of Disease, South Asia Edition 2015, volume 2, Chapter 26, p 1216.
15. Kawabara M, Niwa K, Nishi Y, Mizuno A, Asano T, Masuda K, Komatsu I, Yamazoe M, Takahashi O, Hisatome I, "Relationship between serum uric acid and hypertension among Japanese individuals not treated for hyperuricemia and hypertension," Hypertension Research 2014 Aug; 37(8):785-9. Doi 10. 1038/hr.2014.75. Epub 2014 Mar 27.
16. Jae Joong Lee, Jeonghoon Ahn, Jinseub Hwang, Seong Woo Han, Kwang No Lee, Ji Bak Kim, Sunki Lee, Jin Oh Na, Hong Euy Lim, Jin Won Kim, Seung-Woon Rha, Chang Gyu Park, Hong Seog Seo, Dong Joo Oh, Eung Ju Kim, "Relationship between uric acid and blood pressure in different age groups," Clinical Hypertension 201521:14, DOI: 10.1186/s40885-015-0022-9, 22 April 2015.

Picture Quiz

WHAT IS THE DIAGNOSIS?

A 45 years female patient with four month history of joint pain, fever, cough and ear discharge.



Courtesy: Dr. Muhammad Shahzad Hafeez

See answer at page #37