

Research Article

Comparing Foot Evaluation In Hospitalized Diabetic Patients between Surgeons, Orthopedicians and Physicians Through Amit Jain's Triple Assessment

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Abstract: *Aim* – To assess the compliance of healthcare professionals that include physicians, surgeons and orthopedicians in screening of foot in diabetes and analysing it through Amit Jain's triple assessment. *Methods and materials* –A prospective comparative study was conducted at Raja Rajeswari Medical College, Bengaluru, India, which is a teaching hospital. All the new diabetic patients who were admitted in medicine ward by physicians, surgical ward by general surgeons and orthopaedic ward by orthopaedic surgeon were studied by us and they were divided in 3 groups. Statistical analysis was done using SPSS 22.0 and R environment ver.3.2.2. *Results* – Each group had 20 patients. 80% of patients had diabetes of less than 10 years and there was no difference in both groups. Chronic kidney disease was significantly common in patients in group A (P- 0.039*). Foot screening was done by physicians in 15%, 5% by surgeons and screening of foot was not done by orthopedicians. 3.3% of patients were detected to have foot ulcer during screening. The triple assessment of foot consisting of looking for ulcer/infection, feeling foot pulses and testing for sensation was poor on both feet and there was no difference among all 3 groups. Significant association was noted between detection of ulcer and foot screening (P- 0.003**). *Conclusion* – Screening of foot was extremely low among all the 3 specialists. Amit Jain's triple assessment being the simplest and fastest screening tool, can be done with ease requiring minimum instruments. It is not just the patients who need to be educated, but even health care professionals requires to be educated on need for screening of foot if reduction in amputation is needed and we believe that this linear foot test should be a minimum evaluation tool for every healthcare professional as it addresses the triad of diabetic foot efficiently and effectively.

Keywords: Diabetic foot, Amit Jain, Screening, Ulcer

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INTRODUCTION

Diabetic foot is a commonly known complication of diabetes which is costly to manage and can result in amputation which subsequently lead to poor quality of life (Kurup, R. *et al.*, 2019; Nirantharakumar, K. 2013). It is estimated that around 5% of patients with diabetes will develop ulcers over foot annually and more than half of these foot ulcers will get infected and it can result in amputation (Prajapathi, R. *et al.*, 2018; Moore, T., & Shearman, C. 2008).

Patients suffering from diabetes have 10 to 30 times higher risk of amputation compared to those without diabetes (Kurup, R. *et al.*, 2019; Moore, T., & Shearman, C. 2008; Aalaa, M. *et al.*, 2012). Once a patient is amputated, then there is high chances of re-

amputation and mortality in these patients (Aalaa, M. *et al.*, 2012).

It is well known that the complications in diabetic foot and also amputations can be prevented in more than 75 to 80% of the cases with screening and education (Kurup, R. *et al.*, 2019; Aalaa, M. *et al.*, 2012; Schofield, C. J. *et al.*, 2006; Jain, A. K. C. *et al.*, 2019). However, there are many studies that shows diabetic foot screening is neglected (Jain, A. K. C. *et al.*, 2019). Though, there are few studies done to assess the predictive value of screening (Elsharawy, M. A. *et al.*, 2012), yet it was observed that only 12-20% of foot are actually evaluated in practice (Jain, A. 2018; Kuhnke, J. L. *et al.*, 2013). Further, there are very few studies done on compliance of foot evaluation by health care staffs (Sutkowska, E. E. *et al.*, 2016).

We conducted this unique study to compare the foot evaluation being done in diabetics by 3 different specialists namely physicians, surgeons and

orthopaedicians and analyse it through Amit Jain's triple assessment, a new screening tool from India (Figure 1).

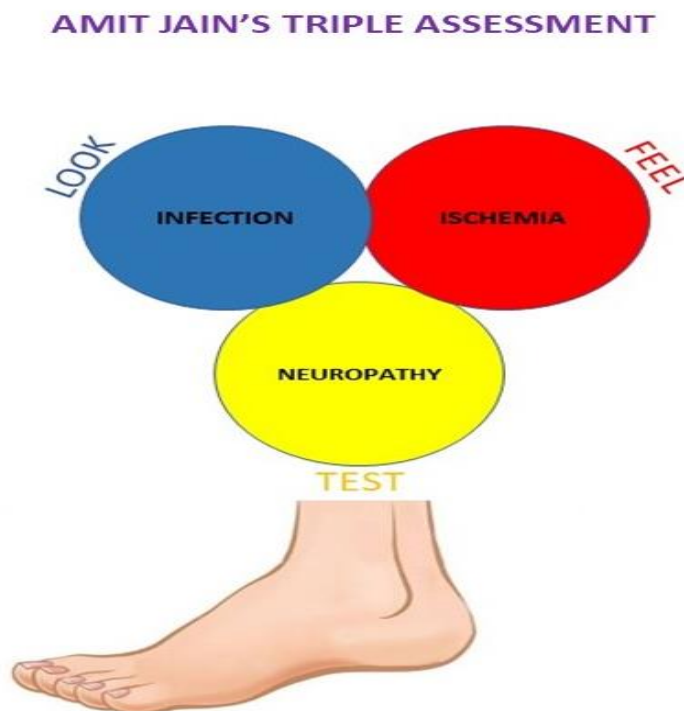


Figure 1 Showing Amit Jain's Linear Foot Test

METHODS AND MATERIALS

A prospective study was conducted at Raja Rajeswari Medical College, Bengaluru, India, which is a tertiary care teaching hospital that caters rural patients. All the new diabetic patients who were admitted in medicine ward by physicians, surgical ward by general surgeons and orthopaedic ward by orthopaedic surgeon were studied by us. These patients were admitted with some systemic problem or for surgeries in respective departments. Patients who were admitted for diabetic foot problems were excluded. The patients were categorized into three groups namely Group A patients seen by physician in medicine wards, Group B patients seen by surgeons and Group C patients seen by orthopaedicians in respective wards.

Data analysis

(Rosner, B. 2000; Riffenburg, R. H. 2005; Rao, P. S. S. & Richard, J. 2006; Suresh, K. P & Chandrashekar, S. 2012).

Data was analysed using statistical software SPSS 22.0 and R environment ver.3.2.2. Microsoft word and excel were used to generate graphs and tables. Both descriptive and inferential statistics were carried out in the study. Results on continuous measurements

were presented on Mean \pm SD (Min-Max) and results on categorical measurements were presented in number (%). Significance was assessed at 5% level of significance.

The following assumption on data is made

- Dependent variables should be normally distributed,
- Samples drawn from the population should be random
- Cases of the samples should be independent

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for qualitative data analysis. Fisher exact test was used when samples were very small. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients.

Significant Figures

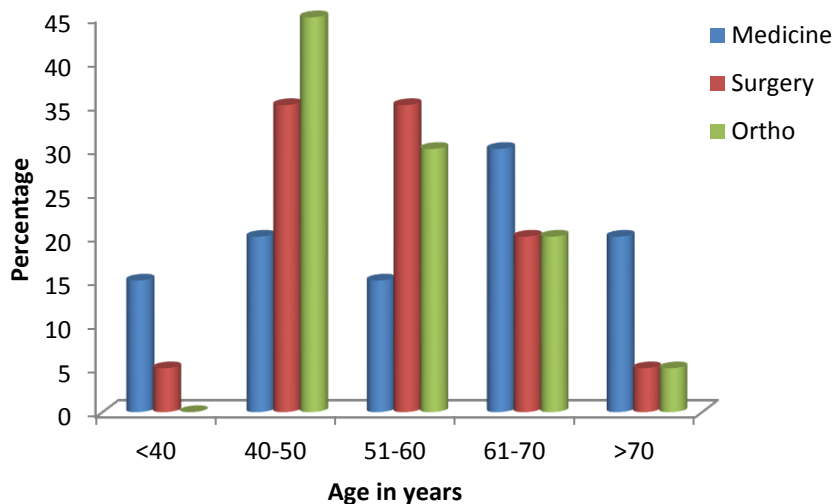
- + Suggestive significance (P value: $0.05 < P < 0.10$)
- * Moderately significant (P value: $0.01 < P < 0.05$)
- **Strongly significant (P value: $P \leq 0.01$).

RESULTS

A total of 60 patients were studied with 20 patients in each group. The average age was 54.98 ± 11.62 years

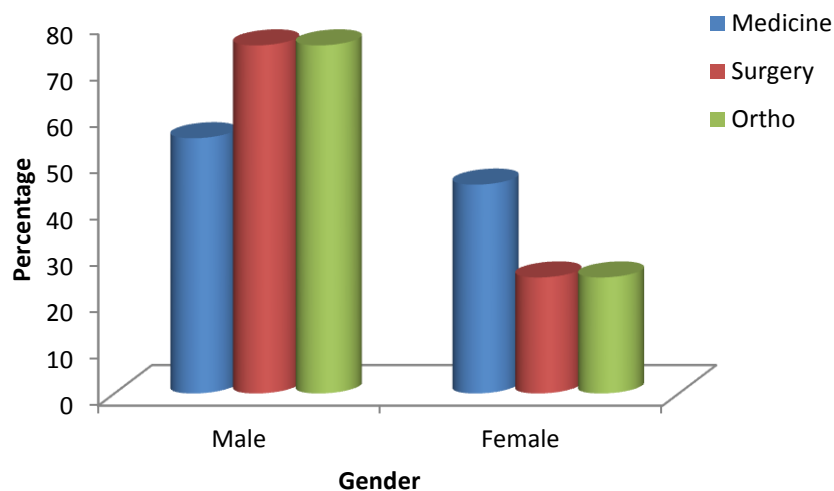
(Figure 2) with no difference among all 3 groups (P-0.267).

Figure 2: Showing age distribution of patients in the 3 groups



Majority of the patients were males (68.3%) with equal gender match (Figure 3) in the 3 groups (P-0.292).

Figure 3: Showing gender distribution



80% of the patients had diabetes of less than 10 years (Table 1).

Table 1: Showing distribution of duration of diabetes mellitus in the three groups

Diabetes Duration(years)	Group A (Physician)	Group B (Surgeon)	Group C (Orthopedician)	Total	P value
<10	11(55%)	17(85%)	20(100%)	48(80%)	P - 0.141
>10	9(45%)	3(15%)	0(0%)	12(20%)	
Total	20(100%)	20(100%)	20(100%)	60(100%)	
Mean \pm SD	7.75 \pm 5.43	5.75 \pm 3.99	5.25 \pm 2.55	6.25 \pm 4.23	

28 patients (46.7%) had comorbidities (Table 2).

Table 2: Showing comorbidities in the three groups of patients

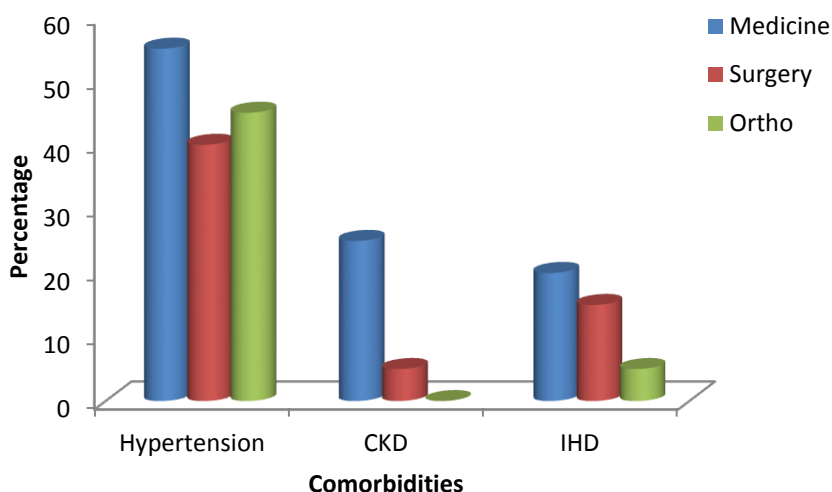
Comorbidities	Group A (Physician)	Group B (Surgeon)	Group C (Orthopedician)	Total	P value
Yes	11(55%)	8(40%)	9(45%)	28(46.7%)	P - 0.626
No	9(45%)	12(60%)	11(55%)	32(53.3%)	
Total	20(100%)	20(100%)	20(100%)	60(100%)	

Hypertension (46.7%) was the commonest comorbidity followed by ischemic heart disease (Table 4). Chronic kidney disease was significantly common (Figure 4) in patients in group A (**P- 0.039***).

Table 3: Showing the types of comorbidities in three groups of patients studied

Type of comorbidities	Group A (Physician)	Group B (Surgeon)	Group C (Orthopedician)	Total (n=60)	P value
Hypertension	11(55%)	8(40%)	9(45%)	28(46.7%)	0.626
CKD	5(25%)	1(5%)	0(0%)	6(10%)	0.039*
IHD	4(20%)	3(15%)	1(5%)	8(13.3%)	0.505

Figure 4: Showing different types of comorbidities in 3 groups.



4 patients (6.7%) had undergone foot screening with no difference in 3 groups (Table 4). 3.3% of the patients were detected to have foot ulcers.

Table 4: Showing foot screening & detection of ulcers in three groups

Parameters	Group A (Physician)	Group B (Surgeon)	Group C (Orthopedician)	Total (n=60)	P value
Foot screening	3(15%)	1(5%)	0(0%)	4(6.7%)	0.310
Foot ulcers	2(10%)	0(0%)	0(0%)	2(3.3%)	0.322

On component distribution of Amit Jain’s triple assessment, it was observed that in overall only 3.3% had seen the right feet (Look Component), 1.7% had felt the pulses (Feel Component) and 1.7% had the sensation checked (Test Component) on the right feet (Figure 5) and there was no difference in all the 3 groups (Table 5).

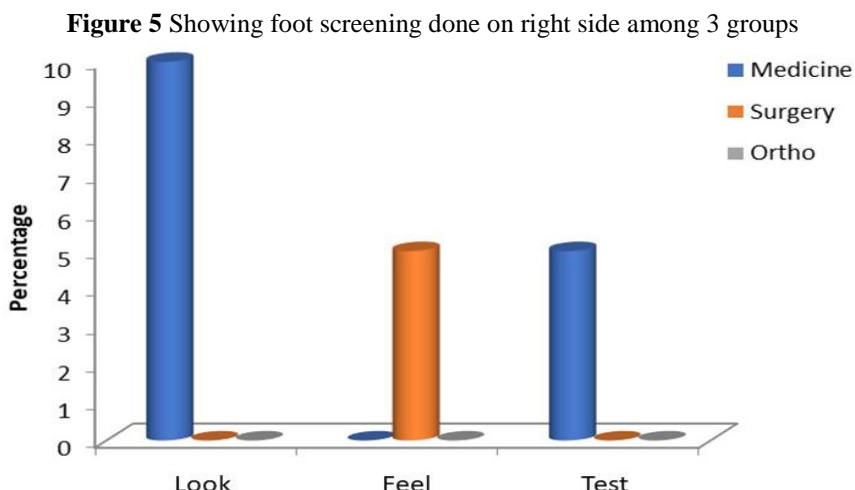


Table 5: Showing the component distribution of Amit Jain’s triple assessment on the right foot in the three groups

Triple Assessment	Group A (Physician)	Group B (Surgeon)	Group C (Orthopedician)	Total (n=60)	P value
Look	2(10%)	0(0%)	0(0%)	2(3.3%)	0.322
Feel	0(0%)	1(5%)	0(0%)	1(1.7%)	1.000
Test	1(5%)	0(0%)	0(0%)	1(1.7%)	1.000

On the left side of the foot (Figure 6), it was observed that on overall, none of the patients had their feet inspected (Look Component), 1.7% had felt the pulses (Feel Component) and 1.7% had their sensation checked (Test Component) and there was no difference in the 3 groups (Table 6).

Figure 6: Showing foot screening done on left side among 3 groups

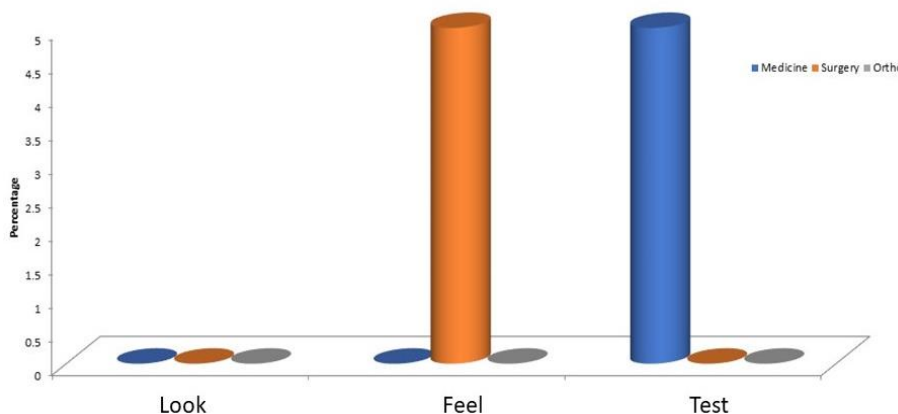


Table 6: Showing the component distribution of Amit Jain’s triple assessment on the left foot in the three groups

Triple Assessment	Group A (Physician)	Group B (Surgeon)	Group C (Orthopedician)	Total (n=60)	P value
Look	0(0%)	0(0%)	0(0%)	0(0%)	1.000
Feel	0(0%)	1(5%)	0(0%)	1(1.7%)	1.000
Test	1(5%)	0(0%)	0(0%)	1(1.7%)	1.000

23 patients (38.3%) had foot symptoms like numbness, burning sensation, etc and there was no difference in 3 groups (Table 7).

Table 7: Showing the foot symptoms distribution in three groups of patients studied

Foot Symptoms	Group A	Group B	Group C	Total	P value
Yes	10(50%)	5(25%)	8(40%)	23(38.3%)	P - 0.262
No	10(50%)	15(75%)	12(60%)	37(61.7%)	
Total	20(100%)	20(100%)	20(100%)	60(100%)	

There was no association between presence of foot symptoms and the foot screening been done in the 3 groups (Table 8).

Table 8: Showing foot screening distribution in relation to foot symptoms of patients studied among the three groups

Foot Screening	Foot Symptoms		Total	P value
	Yes	No		
Group A				
Yes	2(20%)	1(10%)	3(15%)	1.000
No	8(80%)	9(90%)	17(85%)	
Total	10(100%)	10(100%)	20(100%)	
Group B				
Yes	0(0%)	1(6.7%)	1(5%)	1.000
No	5(100%)	14(93.3%)	19(95%)	
Total	5(100%)	15(100%)	20(100%)	
Group C				
Yes	0(0%)	0(0%)	0(0%)	1.000
No	8(100%)	12(100%)	20(100%)	
Total	8(100%)	12(100%)	20(100%)	
Total				
Yes	2(8.7%)	2(5.4%)	4(6.7%)	0.634
No	21(91.3%)	35(94.6%)	56(93.3%)	
Total	23(100%)	37(100%)	60(100%)	

However, significant association was noted between detection of ulcer and foot screening (Table 9) wherein both the patients who had presence of foot ulcers had their foot being screened (**P-0.003****). This was significantly common among the physician (Group A) where foot ulcers were detected on foot screening (**P-0.016***).

Table 9: Showing foot screening distribution in relation to detection of foot ulcer among three groups

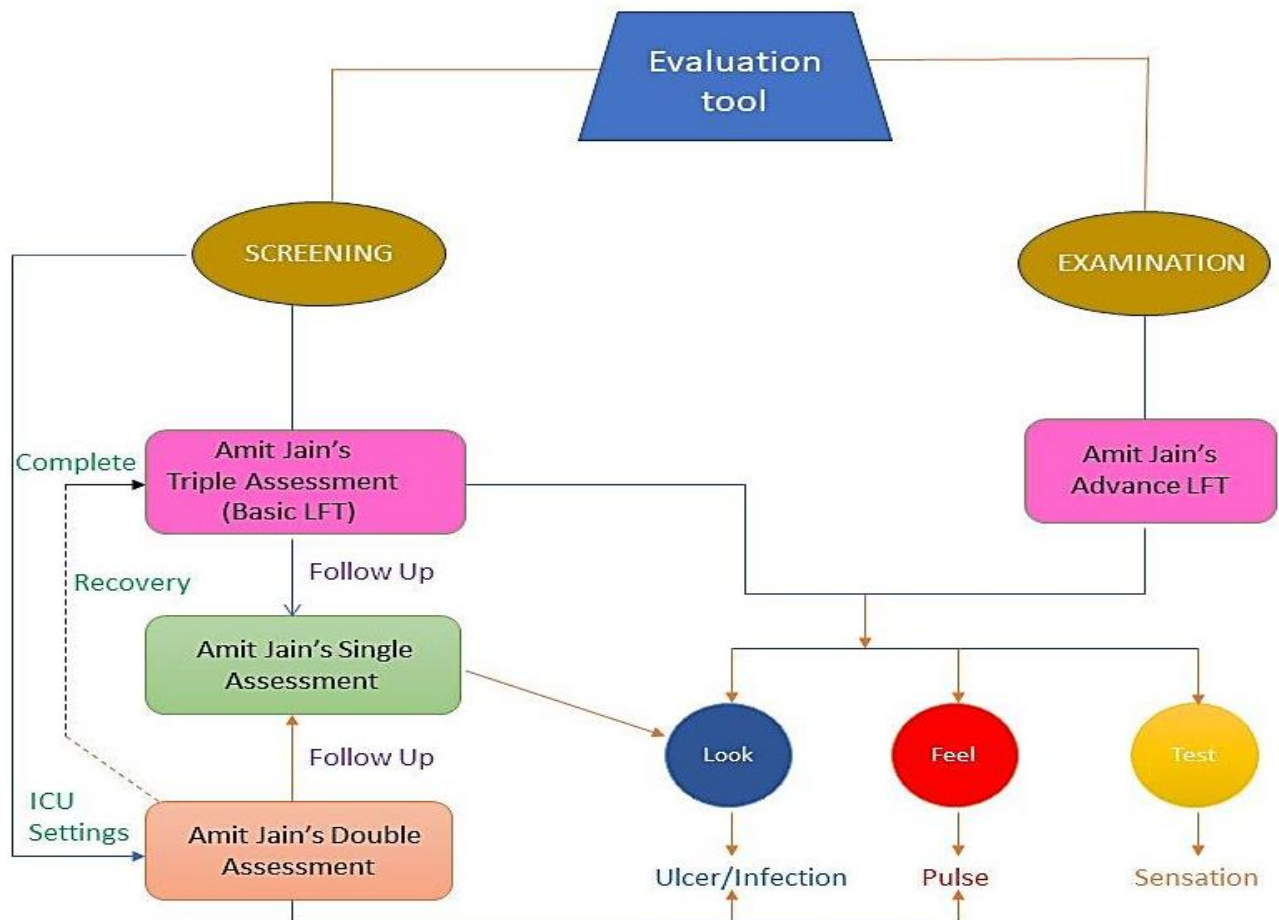
Foot screening	Ulcer		Total	P value
	Yes	No		
Group A				
Yes	2(100%)	1(5.6%)	3(15%)	0.016*
No	0(0%)	17(94.4%)	17(85%)	
Total	2(100%)	18(100%)	20(100%)	
Group B				
Yes	0(0%)	1(5%)	1(5%)	1.000
No	0(0%)	19(95%)	19(95%)	
Total	0(0%)	20(100%)	20(100%)	
Group C				
Yes	0(0%)	0(0%)	0(0%)	1.000
No	0(0%)	20(100%)	20(100%)	
Total	0(0%)	20(100%)	20(100%)	
Total				
Yes	2(100%)	2(3.4%)	4(6.7%)	0.003**
No	0(0%)	56(96.6%)	56(93.3%)	
Total	2(100%)	58(100%)	60(100%)	

DISCUSSION

Diabetic foot disease is a triad of infection, neuropathy and ischemia which could lead to amputation (Jain, A. K. C. *et al.*, 2018; Pendsey, S. 2010). Hence, the aim of screening should be at identifying these entities so that effective measures can be instituted to reduce complications and amputations.

The primary author had earlier divided evaluation of diabetic foot into screening and examination and both of these are different (Figure 7). Screening of the foot involves a quick assessment of essential factors that lead to risk of amputation whereas examination of foot refers to detail assessment which is both laborious and time consuming (Jain, A. K. C. 2017).

Figure 7 Showing the flow chart of Amit Jain’s Linear Foot Test



Amit Jain’s triple assessment for foot in diabetics is a new screening tool proposed from Indian subcontinent (Jain, A. K. C. 2017; Jain, A. 2018). It is also known as Amit Jain’s 10 to 20 second screening tool, Amit Jain’s linear foot test, Amit Jain’s LFT screening tool, etc (Jain, A. K. C. 2017; Jain, A. K. C. *et al.*, 2019). This screening tool (Figure 8) evaluates the foot in diabetics through 3 simple components namely Look, Feel and Test component which addresses the triopathy (Jain, A. K. C. 2017; Jain, A. K. C. *et al.*, 2019).

AMIT JAIN'S TRIPLE ASSESSMENT FOR FOOT

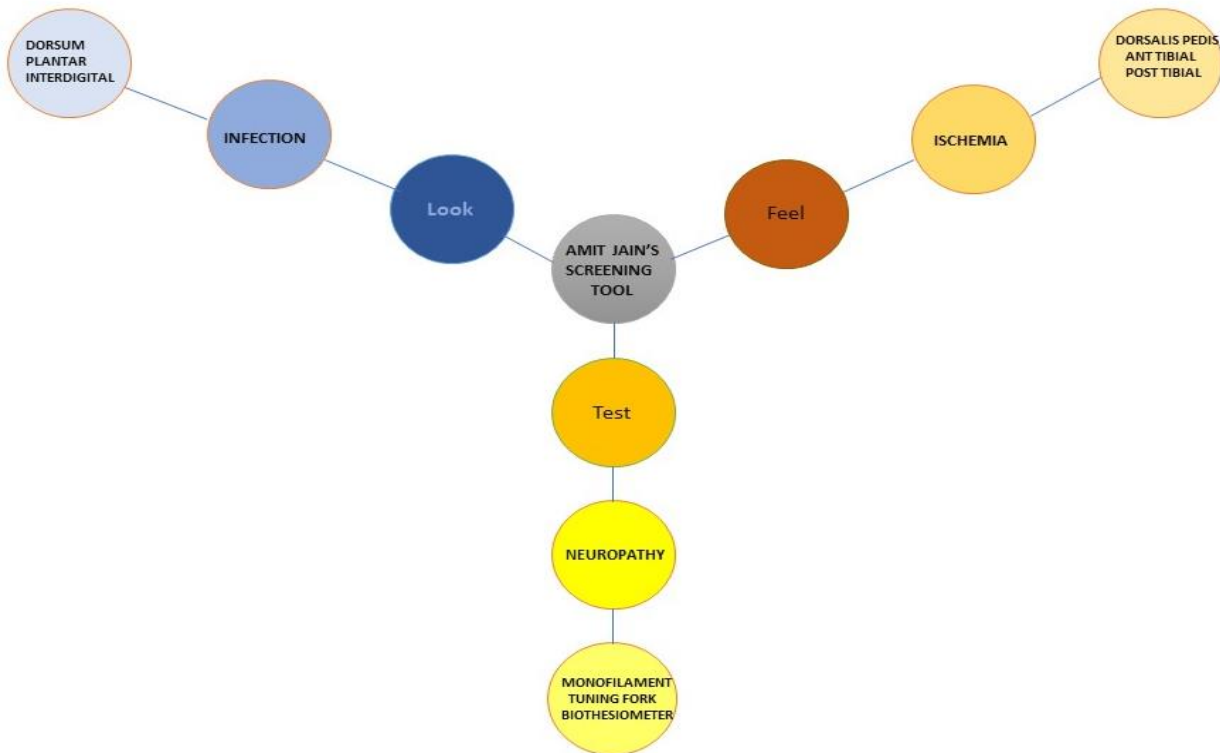
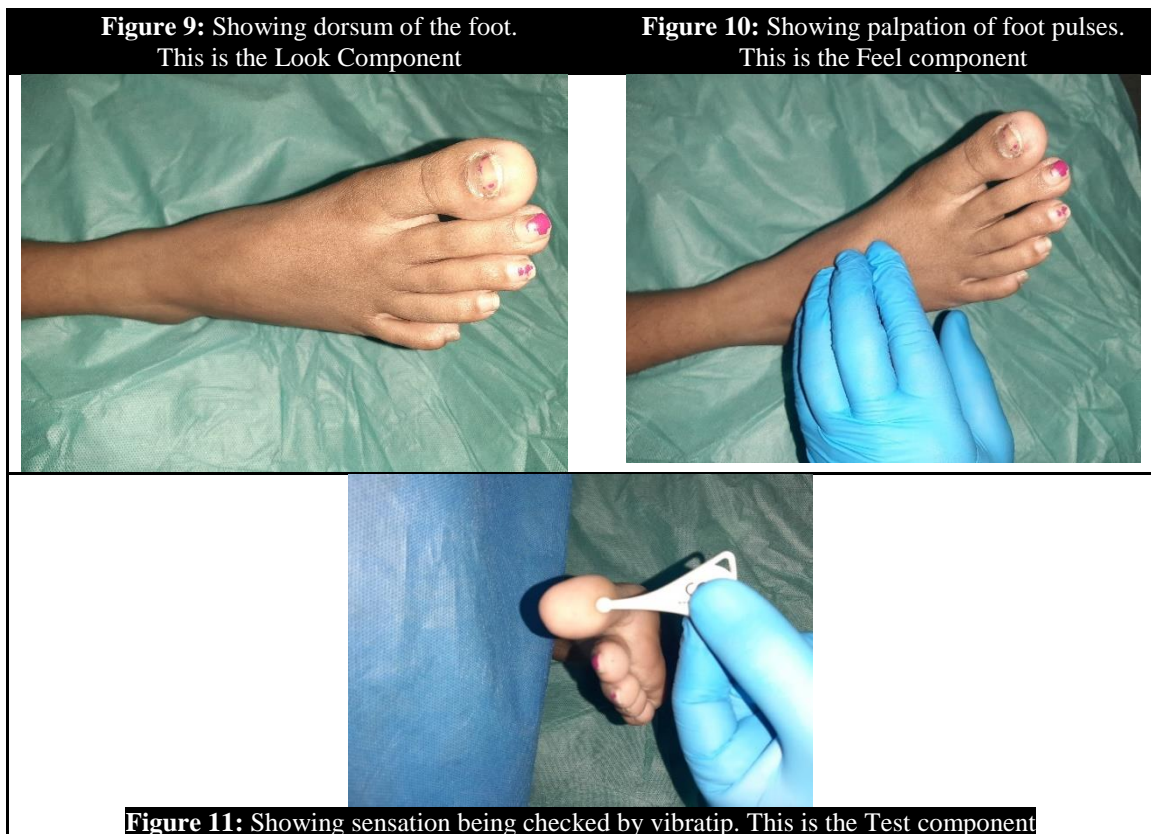


Figure 8 Showing Amit Jain's triple assessment addressing the triad of diabetic foot

The Look component aims to identify ulcer/infection (Figure 9), Feel component (Figure 10) aims to assess the blood supply to foot and the Test component (Figure 11) aims to detect the sensation. In certain scenario, one may have to do double assessment and single assessment (Figure 7).



In a study by Fernandez *et al*, it was seen that screening was performed in only 37% of patients (Fernandez, M. A. *et al.*, 2014). In another study from Pakistan (Kumar, D. *et al.*, 2016), it was observed that only 13.8% of diabetics had their feet evaluated by doctors. In a study by Santosh *et al* from India (Santosh, M. P. *et al.*, 2018), it was seen that only 7.7% of patient's feet were evaluated in diabetics by the physicians. In our study that assesses the foot screening among 3 different specialists, it was noted that 15% of physicians screened the foot, 5% by surgeons and 0% by orthopedicians with overall foot screening being done in 6.7%.

In Elsharawy *et al* series on screening in surgical inpatients (Elsharawy, M. A. *et al.*, 2012), only 4% of patients screened had history of ulceration/amputation. In our series, 3.3% of patients had underlying ulcers detected during screening.

It is well known that peripheral neuropathy is responsible for 80% of ulcers (Aalaa, M. *et al.*, 2012). In Santosh *et al* series (Santosh, M. P. *et al.*, 2018), none of the patients had sensation checked by the physician. Even in study by Ismail *et al* (Ismail, I. *et al.*, 2015), none of the foot were tested for sensation. In our series, sensation was checked by physician in 5% of the cases and the orthopedicians and surgeons did not check sensation.

The distal foot pulses palpation is one of the simplest methods taught during medical training and it is quick and no instrument is required. In Santosh *et al* series, only 1.5% had their pedal pulses being palpated (Santosh, M. P. *et al.*, 2018). In this series, pulses were palpated by surgeons in 1.5% of the cases and the physicians and orthopedicians did not palpate foot pulses in any patient.

CONCLUSION

Screening is one of the most important strategy in prevention of diabetic foot complications and amputations. Even now, the compliance of screening the foot in diabetes among healthcare professional be it either physician, surgeon or orthopedician is found to be very low. Amit Jain's screening tool is one of the simplest, fastest and effective screening tools that addresses the triad efficiently and it should be considered at least a minimum and mandatory screening tool for all health care professional dealing with diabetes if a reduction of amputation is needed. This screening tool has many advantages and can be performed with ease.

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Conflict of Interest- None

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Ethical Approval – The study was approved by Institutional ethics committee (RRMCH-IEC/03/2018-19)

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