

Triangles in diabetic foot

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Abstract

Numerous new concepts have been laid down in field of diabetic foot over past few years. The aim of this article is to review and add information on various different triangles in diabetic foot exclusively as well as triangles that can be applied in diabetic foot specialty from other specialty field. The purpose of these triangles ranges from being simple teaching models to providing guidance in treatment. Some triangles in diabetic foot can be multipurpose. The triangles in diabetic foot are newer concepts and we hereby describe some of the newly proposed named and unnamed triangles, acquaintance of which would help the clinicians in their practice and academic knowledge.

Keywords: diabetic foot, amit jain, triangle, footwear, offloading, amputation

Introduction

There are numerous proposed triangles in surgical field from head to toe. The purpose of all is different. A few of these triangles are in vogue and a few are forgotten [1]. Few of these are named triangle after its describer and few are unnamed.

Large numbers of such triangles are anatomical in nature wherein the boundaries of the triangles are formed by different structures and they are aimed at identifying another important/vital structure like a nerve or vessel, some of which are essentially important to be identified especially during surgery to avoid damage and major complications [1, 2].

With time, the triangles were extended beyond anatomical boundaries and were used for different purposes including teaching models, treatment options and guiding in decision making and management.

There are various newly proposed triangles for diabetic foot and there are few triangles from other field that can be applied in diabetic foot like the reconstructive triangle from plastic surgical field, the triangle of wound assessment from wound care field, etc [3, 4]. Again the purpose of these ranges from teaching models to guidance in treatment. A short description of these triangles is as follows.

Triangle of Wound Assessment

This new tool divides (Figure 1) assessment of wound in 3 areas namely wound bed, wound edge and peri wound skin [5]. It is a framework supporting decisions on wound management [4]. For wound bed, it aims to look for type of tissue, exudates level and presence of infection. For wound edge, look for undermining or rolled edges and for peri wound skin, look for any macerations, excoriations, hyperkeratosis, etc.

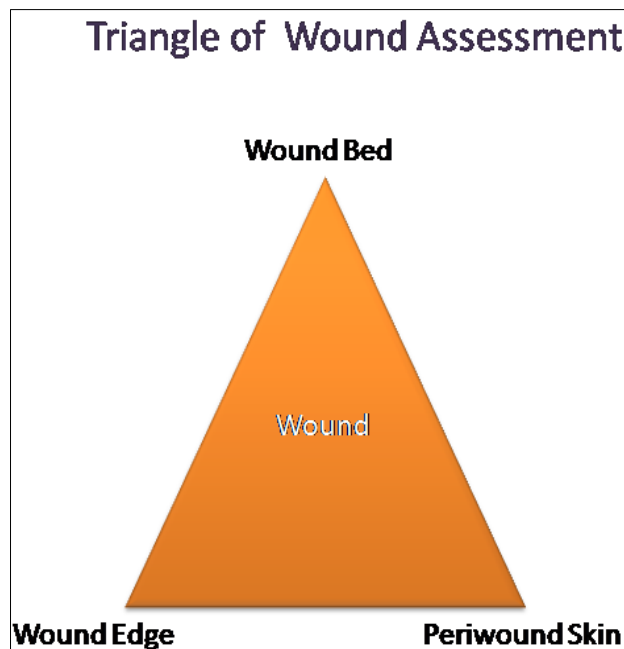


Fig 1: Triangle of Wound Assessment

Reconstructive Triangle

This, apparently a modification/variant of reconstructive ladder, was proposed by Mathes and Nahai [6]. This triangle encompasses tissue expansion, flap transposition and free tissue flap transfer [3, 6]. It was proposed to incorporate the newer developments in plastic surgical field.

Triangle of Foot Amputation

This was proposed recently by the author along with other new triangles for diabetic foot [7]. These new triangles were derived from Amit Jain’s extended ‘SCC’ classification [7]. These new triangles aim to simplify our understanding by providing available options, categorizing them and help in systematic approach to the condition to achieve the desire goal. They serve as good teaching tool in diabetic foot.

For effective foot salvage, the triangle of foot amputation offers different options of minor amputations in foot (Figure 2) and they include the simple foot amputations, the complex foot amputations and the complicated foot amputations [7]. All types of amputations done in forefoot are simple amputations, amputations of midfoot are complex amputations and amputations of hind foot are complicated amputations [8].

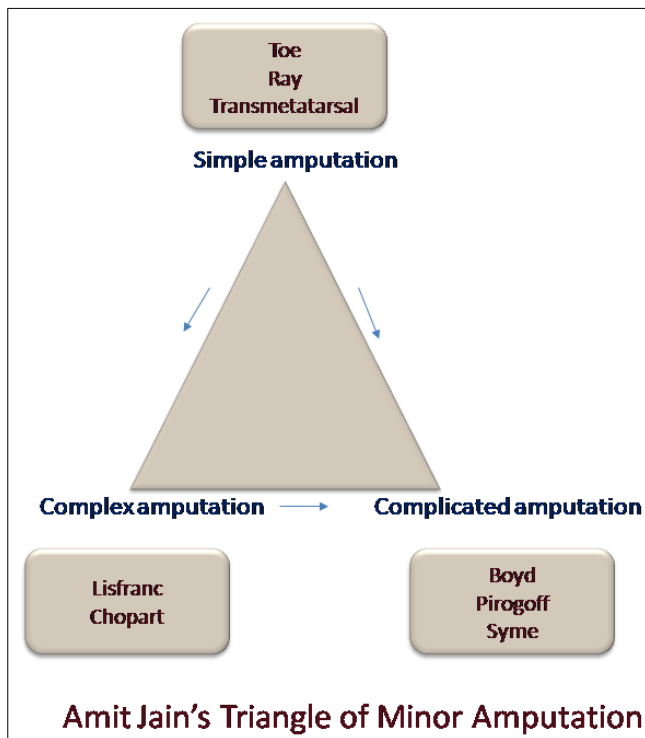


Fig 2: Triangle of Foot Amputation

This teaching model provides entire options available for amputations in foot to the clinicians, so that they can choose the most appropriate one based on clinical scenario to salvage the foot. A recent study showed that most surgeons in a teaching hospital perform simple foot amputations (100%) and complex and complicated foot amputations were rarely performed [8]. Such amputation definitely requires clinical expertise to perform.

Triangle of Therapeutic Footwear

Derived from same Amit Jain’s extended ‘SCC’ classification, this teaching model also offers 3 distinct options (Figure 3) available both to the clinicians and to the patients to choose appropriate therapeutic footwear’s ranging from simple to complicated variety [7].

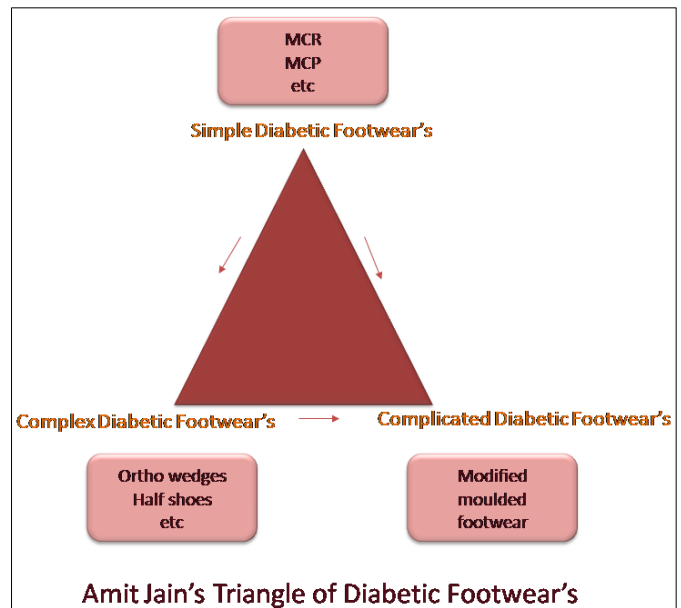


Fig 3: Triangle of Therapeutic Footwear

The 3 corner areas of the triangle of diabetic footwear (therapeutic) represents the options available to diabetic patients and they include simple, complex and complicated footwear’s [9]. Simple footwears, like microcellular rubber sandals, are those that are easy to prepare, complex footwears include those that require some modifications and are difficult to prepare whereas complicated footwears are most difficult to prepare and require expertise and high-end machinery/equipments to manufacture them. A study by Jain *et al* showed that 81.5% of patients with diabetic foot were on simple footwears with 11.1% being on complex footwear’s and 7.4% on complicated therapeutic footwear’s which consist of custom-made molded footwear’s [10]. Simple therapeutic foot wears like Microcellular rubber (MCR) footwear’s or MCP footwears are easily developed and available in various South East Asian countries like India [9].

Triangle of Offloading

Offloading is one of the main modalities in management of diabetic foot especially plantar ulcers and Charcot foot. It aims at decreasing the plantar pressure so that healing is smooth in case of ulcers. Numerous offloading devices are available in clinical practice [11]. The offloading triangle also offers different options available and they include simple offloading, complex offloading and complicated offloading [7]. This Amit Jain’s “SCC” classification for offloading was based on ease of application/use of an offloading in clinical practice [12]. Simple offloading’s are those which are easiest to use/devise and apply on foot. Complex offloading requires time to apply and is usually manufactured in companies whereas complicated offloading requires lot of time and expertise to apply on the foot [12]. The clinician can choose the best options suitable to the patient and also available in their places. This triangle was proposed to incorporate all the offloading including the newer ones in diabetic foot field (Figure 4).

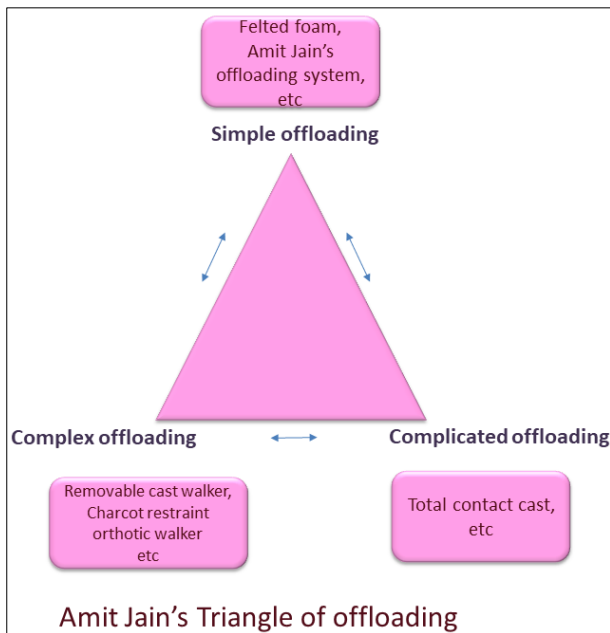


Fig 4: Triangle of offloading

Triangle of Diabetic Foot Ulcer Classification

This triangle serves an excellent teaching tool (Figure 5) and it simplifies the understanding of ulcer classifications in diabetic foot. There are various types and purpose a classification is proposed. This triangle encompasses the Amit Jain's descriptive classification of diabetic foot ulcer, ulcer coding and ulcer scoring proposed by the author [13]. The clinician can use the descriptive classification to categorize the lesion, can add coding to and can also score the diabetic foot ulcer to assess the outcomes.

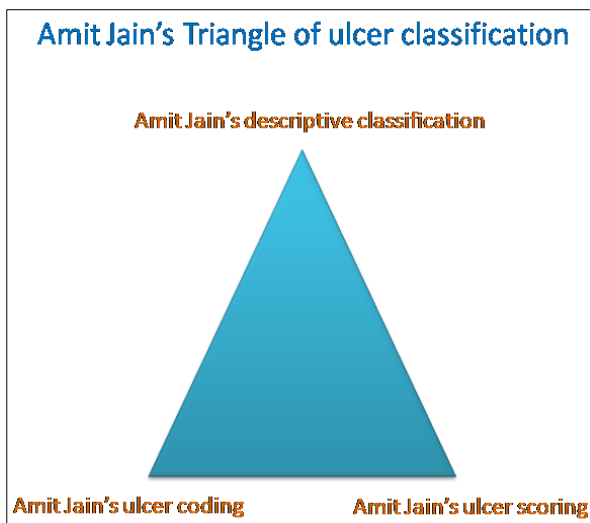


Fig 5: Triangle of ulcer classification

Triangle of Diabetic Foot Surgery

This new triangle is again based on Amit Jain's SCC classification system [14]. The triangle provides surgical options available in diabetic foot. The surgeries in diabetic foot are either simple, complex or complicated and each of these represent the corner of the triangle (Figure 6).

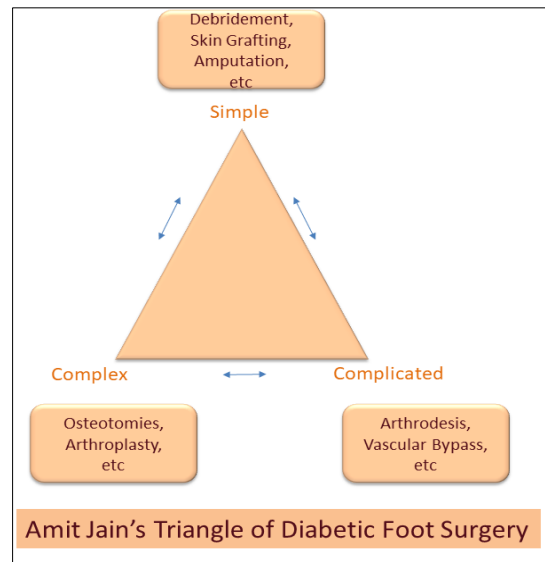


Fig 6: Triangle of diabetic foot surgery

Triangle of Diabetic Foot Screening

This new triangle (Figure 7) is in similar lines to Amit Jain's diabetic foot ulcer triangle. The corner of the triangle represents the Amit Jain's descriptive screening tool known as triple assessment/ LFT screening tool, the coding of the LFT screening tool and the scoring of this LFT screening tool [15]. Recently the scoring system of this screening tool was validated [16]. A screening tool that also has a coding and scoring along with a triangle is rare in literature.

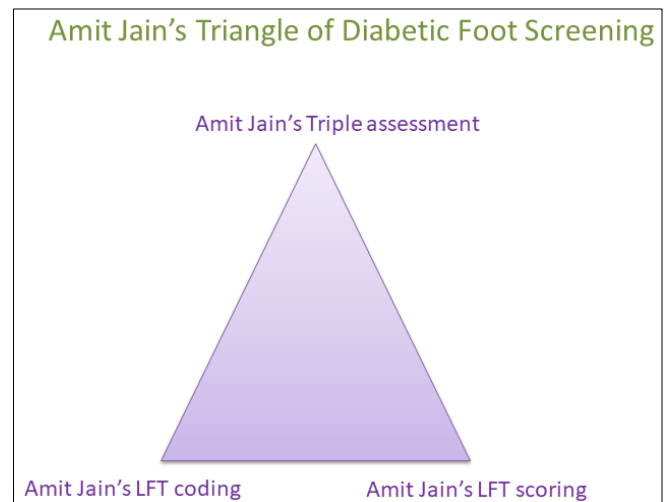


Fig 7: Triangle of diabetic foot screening

Conclusion

Numerous new concepts have evolved in diabetic foot field. Few are newly designed whereas few others are derived from other fields. The triangles in diabetic foot consist of both the newly designed Amit Jain's diabetic foot triangles as well as those from other field suitable to diabetic foot also. The triangles have both theoretical as well as practical usages. Most of these triangles simplify our understanding of diabetic foot concepts as well as guide in treatment and provide wide variety of options available in diabetic foot field. They can serve as excellent teaching tool.

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