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Editorial

Emerging Trends and Recent Advances in Microvascular Anastomosis in Reconstructive Surgery

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Ablative procedures in head and neck region requires composite removal of tissues during excision. This results in compromise of both functional activities and aesthetic mutilation. Reconstruction of major extirpative defects is an extremely challenging task [1]. During the last three decades there has been tremendous progress in the field of reconstructive surgery particularly with the advent of micro vascular free tissue flaps [2]. The transfer of vascularised free tissue is a cornerstone of modern reconstructive surgery which has improved the quality of life in many patients [3].

Ever since Jacobson and Suarez (1960) described the first silk sutured micro vascular anastomosis [3,4], there has been major breakthrough and continuous refinements in microsurgical anastomosis techniques [2]. The reported success rate of free flaps ranges from 91% to 99% [3] with majority of failure rates being due to technical errors in performing anastomosis [5]. Microsuturing with 8-0, 9-0 nylon has been the successful standard method of vascular anastomosis [1,6,7]. However, it requires extensive training for a surgeon to obtain the expertise in performing anastomosis of small caliber vessels with diameter less than 1 mm [6].

The most significant damage to vessel wall during anastomosis is from needle and suture penetration which causes insult of the medial and intimal layers which may induce vasospasm [5,6]. Faulty techniques can lead to endothelial lacerations, subendothelial collagen exposure and subsequent platelet aggregation [5]. To overcome this several alternatives have emerged in the past four decades which includes several non-suturing anastomotic techniques such as Micro vascular couplers, vascular closure systems (staplers), Laser Assisted Vascular anastomosis (LAVA) and fibrin sealant reinforced micro suturing and have gained credibility with promising results [6,7]. The objectives of such alternatives were to reduce vessel wall damage thereby minimizing endothelial disruption and favorably influencing the patency rate, to decrease ischemia and surgical time and to ease the challenge of microsurgery.

Microvascular coupler anastomosis

In 1962 the Nakayama device was released which consisted of 2 metallic rings and 12 interlocking pins with corresponding holes. However, this device did not gain widespread acceptance until 1986 when Ostrup and Berggren introduced their modified version as the Unilink Microvascular Anastomotic System (Synovis MCA, Birmingham, Ala) [4]. The device consists of 2 disposable rings made of high-density polyethylene, with a series of 6 to 8 stainless steel pins evenly spaced around each ring. The inner diameter of the rings range in size from 1.0 to 4.0 mm, allowing anastomoses of vessels that are 1.0 to 4.5 mm in diameter [1,4].

Widely cited advantages include intima-to-intima anastomosis and reliable vessel eversion, thereby avoiding a potentially thrombogenic foreign body within the vessel lumen [1,4,6]. The other advantages of the coupler is its ease of technical use as compared with hand-sewn venous techniques [1] and time-savings over a sutured anastomosis [3]. Concerns regarding technical performance of the anastomosis, including vessel wall thickness, small diameters, mismatch caliber of the vessels and high-pressure flow across the anastomosis, have severely limited the acceptance of arterial microvascular coupling [4].

In stapler anastomosis non penetrating titanium clips are applied in an interrupted, everting fashion. The vessel wall ends are brought together and stapling is done only on the outer layer without insulting the endothelium thus reducing post-operative events such as bleeding and thrombosis at the anastomosis [5,6]. Lab studies have shown faster endothelization using clips compared to sutures, the same strength as sutures, and long term there are no differences histologically in relation to intimal thickness, anastomotic stricture, or patency rates [5]. Another advantage of staples is the reduced operating time to perform anastomosis and possible cost savings in free flap surgery.

Laser-assisted vascular anastomosis (LAVA)

Methylene blue dye acts as a wavelength specific chromophore and is applied to the approximated prepared vessel walls to absorb the laser energy. The laser will be set as a continuous wave (CW) at output powers of 2000 mW. Anastomosis will be achieved by a total of 6 - 9 shots on the vessel wall, 2 to 3 shots between each suture of 0.6 mm spot diameter, 5s duration and 2000 mW power using diode lasers with fibre optic probe. A change in colour from blue to brownish-black colour at the anastomotic site indicates the completion of protein coagulation and anastomosis [6].

Fibrin glue reinforced microsuturing

The vessels are prepared and 6 to 7 interrupted sutures are placed with 8-0 prolene similar to the conventional method. Simultaneously the two-component fibrin sealant will be formulated where the Component 1, the sealer consists of protein solution lyophilized human fibrinogen, aprotinin, polysorbate 80 and component 2 thrombin solution (human thrombin, chloride). The fibrin sealant will be applied covering the anastomosis and will be left undisturbed for 2 to 3 minutes allowing the solution to polymerize. The anastomotic time by this technique is almost equal to the time taken for anastomosing using conventional suturing despite placing fewer sutures, as the formulation of fibrin sealant requires additional time. The major disadvantage of applying fibrin glue is the possibility of seepage of glue into the vessel, which may precipitate thrombus formation, and this eventually may become an embolus [6].

Non-suturing Micro vascular anastomosis techniques offers safer, reliable and better alternatives to the conventional micro suturing. In spite of many advantages over the suturing technique, non-suturing anastomosis is preferred only for venous anastomosis as the strength is inadequate for arterial anastomosis.

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