ORIGINAL RESEARCH PAPER

Volume-7 | Issue-10 | October-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ACCURACY OF HAND HELD DOPPLER IN LOCALISING PERFORATORS

Plastic Surgery

Dr Sanjay Kumar* Senior Resident, Department Of Plastic Surgery, NMCH, Patna. *Corresponding Author

Dr S.K. Jha Assistant Professor, Department Of Plastic Surgery, NMCH, Patna.

ABSTRACT

In the current era,where perforator flaps are mainstay of reconstruction,hand held Doppler is very useful.Pre-operative localisation of perforators helps greatly in designing and elevating flaps.While there are many other more accurate and sophisticated modalities for perforator localisation,the current literature is lacking with the accuracy of hand held Doppler in localising perforators pre-operatively.**Aims and objectives:** to establish the accuracy of hand held Doppler in localising perforators.**Material and methods :** 21 patients of leg defects undergoing perforator flap reconstruction were evaluated prospectively in the department of plastic surgery,nalanda medical college and hospital,patna,india during January 2017 to july 2018.Hand held Doppler with 8MHz probe was used to localise perforators in the vicinity of defect to assist in flap elevation which was compared during operative exploration.**Results :** out of 56 perforators marked pre-operatively,45 were localised intra-operatively.Sensitivity was found to be 93.33% with positive predictive value of 87.5% and lack of specificity.**Conclusion :**hand held Doppler device is a very useful tool in planning perforator based flap surgery despite its few limitations.

KEYWORDS

Perforator Flap, Hand Held Doppler.

INTRODUCTION:

Soft tissue defects in the lower limb, following trauma, frequently require reconstruction using perforator flaps. Pre-operative localization of perforators avoids prolonged operation time, intra-operative mishappenings,allows for better flap planning(1) and increases surgeon's confidence. Conventional hand-held dopplers are very popular in many plastic surgery units because it is technically not difficult to use, economical and easy to transport.With its few limitations it is still very useful tool in the reconstructive surgeons armamentarium.

MATERIAL & METHODS :

The perforators in the vicinity of the defect were localized pre-operatively with hand held unidirectional Doppler probe of 8 MHz. The axis of the major vessels were surface marked(2) and perforators searched 1-1.5 cm on both the sides of the axis,keeping in mind the perforator topography(3,4,5) and surface marking of soleus muscle, as it is this muscle from the border of which majority of septocutaneous perforators emerge.

The discrimination between the axial artery and the perforators is sometimes difficult in lower leg where axial vessel is close to the perforator.The axial artery has a unidirectional pulsating course whereas there is no evident pulsating sound around the perforator (6). The size of the perforator is evaluated by the sound intensity; sometimes repeated examinations are required to identify the most suitable perforator for the planned flap .

RESULTS :

Total 56 perforators were marked pre-operatively in the vicinity of the defect out of which only 42 could be localized at the time of flap elevation. The remaining sites couldn't be explored during surgery. 6 sites marked were false positives(perforators not found intra-operatively) and 3 were false negative(found perforator where not marked pre-operatively, because the site was not searched preoperatively). Sensitivity was found to be 93.33 % with positive predictive value of 87.5 %.

TABLE 1 : Perforators marked preoperatively with hand held Doppler and found intra-operatively.

S.No	Vessel	Pre-op	Intra-op
1	PTA	10,12	10,12
2	ATA	18,21,23	18,21,23
3	PTA	6,8.5,11[a]	6,8.5
4	PTA	6,9	6,9
5	PTA	6,8.5	2[c],6,8.5
6	ATA	3,5.5[a]	3
7	PA	12.5,15[a]	12.5
8	PTA	4,6[a],10[b]	4
9	PTA	3[b],6,9	6,9
10	PTA	4[b],6,9	6,9
11	PTA	4.5[b],8,11,14	8,11,14
12	PTA	8[a],15	15
13	PA	6,9,11.5	6,9,11.5
14	PA	8[b],11,13	11,13
15	PTA	8,13	4[c],8,13
16	PTA	5[b],8,13	8,13
17	PA	8,12[a],15[b]	8
18	PTA	6[b],9,13	9,13
19	PTA	12,16,18	8,12,16,18
20	PTA	5,9	5s,9
21	PTA	4,8,12	4[c],8,12

ATA-anterior tibial artery,PTA-posterir tibial artery,
PA-peroneal artery
a – false positive.
b – the zone which was not looked for intra-op.
c– false negative.

Distances are in centimetre from tip of malleoli.

TABLE 2 : Accuracy of hand held Doppler in localising perforators

True positive	42 out of 48(total perforators marked and searched intra-op)
True negative	Not applicable (no perf. –no signal)
False positive	6 (perforators not found intra-operatively at marked site)
False negative	3 (found perforator where not marked pre-operatively, because the site was not searched preoperatively)
Sensitivity	True positive/total positive=42/45= 93.33%
Specificity	Not applicable
Total perforators marked pre-op : 48 + 8=56.	
Total perforators found intra-operatively =48	

positive predictive value : 42/48 = 87.5 %

DISCUSSION :

Pre-operative localization of perforators aid in the dissection,as described by various authors(1,6,7,8,9,10). Perforators vary in location and caliber among individuals but there are certain areas where they can be expected,in a given population.(1). However hand held Doppler is operator dependent but can give reliable result with some false positive results due to small subcutaneous vessles or perforator(1).Identification of the perforator vessel can be done easily if it is performed cautiously around the regions that contain perforator

vessels that arise from the axial vessels, such as the thoracodorsal region, abdominal region, and thigh(10) but in distal leg where soft tissue bulk is less and the axial vessels are too close to perforators,their delineation is difficult and requires a long learning curve to interpret the acoustic difference the perforator makes over the axial vessel.

We have found sensitivity of 93.33 % in localising perforators using 8 MHz hand held doppler probe which was consistent with other similar studies.(1,8,10,11)with low specificity. The positive predictive value was 87.5 %. The downside of this device is that it may be too highly sensitive, and thereby often locates not only clinically significant perforators but also very small perforators that are insufficient to support the flap.

This lack of specificity has been well documented in its use for locating perforators in the anterior lateral thigh flap(12).

Hand held Doppler is one of the most inexpensive and common techniques for locating perforators. Because of it's lack of specificity, use of the hand-held Doppler alone has not been considered reliable for perforator mapping by many workers(9).It is clearly established that it does not achieve the sensitivity and breadth of information available with the other imaging technologies. It remains a useful tool for intraoperative evaluation to document and follow the course of a chosen perforator during dissection.

Blondeel et al in 1998 (7) recommended easier and cheaper unidirectional Doppler flowmetry for more constant perforators of SGAP flaps whereas colour duplex scanning for perforators having more variable anatomy (viz;DIEP and TAP flaps) in an attempt to carry out the operative procedure in a faster and safer way.

Newer methods CTA,MRA(9), Multidetector row CT(13), angioscanning(14) are definitely more accurate than the hand held Doppler as they provide accurate location as well as its flow characteristics. But in our cost constrained clinical setting of developing country, we agree with the reports of Taylor(1), Hallock(8) and Wei(10),and find hand held Doppler a very useful clinical tool to plan our flap.We think that a variation of 5-7 mm in exact perforator location is seldom significant enough when we plan to raise a flap on the perforator. It gives idea to the surgeon about the approach to perforator and saves time.

CONCLUSION:

Hand held Doppler probe ,despite its few limitations, still is a very useful tool,in perforator localisation. It saves lot of time in intraoperative perforator localisation as well as is helpfull in designing of flap.Although many other technologies are now available for more accurate perforator localisation,these are not easily available or accessible for poor patients and needs radiological expertise. Hand held Doppler has a little learning curve, is quite affordable and accurate enough for perforator mapping in leg.

CONFLICT OF INTEREST:NONE
SOURCE OF SUPPORT :NONE

REFERENCES

1. Taylor GI, Doyle M, Mc Carten G. The Doppler probe for planning flaps: anatomical study and clinical applications. Br J PlastSurg 1990;43:1–16.
2. Bhattacharya V, Watts RK. Ipsilateral fasciocutaneous flap for leg and foot defects. Indian J Plast Surg 2003;36:30-5.
3. Geddes CR, Tang M, Yang D, et al. Anatomy of the integu¬ment of the lower extremity. In: Blondeel PN, Morris SF, Hallock GG, et al., editors. Perforator flaps: anatomy, tech¬nique & clinical applications. St. Louis: Quality Medical Publishing, Inc.; 2006. p. 541-78.
4. Fix R J, Vasconez L O. Fasciocutaneous Flaps in Reconstruction of the Lower Extremity. Clin Plast Surg 1991;18(3):571-82.
5. Schaverien M, Saint-Cyr M. Perforators of the lower leg: analysis of perforator locations and clinical application for pedicled perforator flaps. Plast Reconstr Surg. 2008 Jul;122(1):161-70.
6. Naci Celik, MDa, Fu-Chan Wei. Technical tips in perforator f lap harvest. Clin Plastic Surg 30 (2003) 469– 472
7. Blondeel PN, Beyens G, Verhaeghe sR, Van Landuyt K, Tonnard P, Monstrey SJ, Matton G. Doppler flowmetry in the planning of perforator flaps. (Br J Plast Surg. 1998 Apr;51(3):202-9.)
8. Geoffrey G. Hallock. Doppler sonography and color duplex imaging for planning a perforator f lap. Clin Plastic Surg 30 (2003) 347– 357.
9. Mathes D W, Neligan P C. Preoperative Imaging Techniques for Perforator Selection in Abdomen-Based Microsurgical Breast Reconstruction. . Clin Plast Surg 37 (2010) 589-591.
10. F.-C. Wei, N. Celik. Perforator flap entity. Clin Plastic Surg 30 (2003): 325–329.
11. Umar Daraz Khan. J. G. Miller. Reliability of Handheld Doppler in Planning Local Perforator-Based Flaps for Extremities. Aesth Plast Surg. 2007: 31;521-25
12. Yu P, Youssef A. Efficacy of the handheld Doppler in preoperative identification of the cutaneous perforators in the anterolateral thigh flap. Plast Reconstr Surg 2006;118(4):928.
13. Ono S, Chung KC, Hayashi H, Ogawa R, Takami Y, Hyakusoku H. Application of multidetector-row computed tomography in propeller flap planning. Plast Reconstr Surg. 2011;127(2):703-11.
14. Higueras et al. Use of angioscanning in the surgical planning of perforator flaps in the lower extremities. J Plast Reconstr Aesthet Surg. 2011 Sep;64(9):s1207-13.