



Ultrasound-assisted definition of inferior border of the trapezius muscle in lower trapezius island flap reconstruction

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Abstract

Utilization of lower trapezius island flap (LTIF) provides an alternative in reconstruction of the select defects in head and neck region. When muscle bulk is needed under the skin paddle, it may be important to know the exact location of the inferior edge of the trapezius muscle (TM) in order to design the skin paddle accordingly. Due to the anatomic variations seen especially in the origin of trapezius muscle, there are no reliable surface landmarks to define the inferior edge of TM. We present a simple ultrasound-assisted technique of identifying the inferior border of TM preoperatively.

Level of Evidence: Level V, diagnostic study.

Keywords Trapezius · Muscle · Flap · Ultrasound · Reconstruction

Introduction

The lower trapezius island flap (LTIF) is an alternative modality for head and neck reconstruction in select cases, where a pedicled musculocutaneous flap is desired [1, 2]. Although the anatomy of the trapezius muscle (TM) is well known, the origin of TM may be highly variable. It has been shown in a classical study involving 160 TM dissections in cadavers, that the origin of the TM may be higher than the 12th thoracic vertebra in more than 50% of the time, and could be as high as 8th thoracic vertebra, which directly affects the position of its lower border [3]. Preoperative determination of the exact location of the inferior border of

TM is of utmost importance, since it may give the surgeon an idea of pedicle length sufficiency for the intended recipient area, especially in cases where muscle bulk is desired under the entire skin paddle, such as periauricular skin defects with lateral temporal bone resection and/or radical parotidectomy. Unfortunately, there are no reliable surface landmarks for defining the inferior border of the TM. We present a technique of preoperative ultrasonography (US) to successfully define the inferior border of the TM for LTIF reconstruction.

Method

Inferior border of the TM was identified by using a GE Logic 9-US machine (General Electric, Milwaukee, WI) with a linear M12L-transducer (12 Mhz, 2 in. footprint) in a patient undergoing LTIF, preoperatively (Fig. 1). The inferior border of the muscle was then followed with the transducer from the medial edge of the scapula superolaterally to the spine inferomedially with simultaneous marking the course of the inferior edge of the TM on the skin with a marking pen. Then the intersections of this line with the medial scapular border and the spine were also marked on the skin. The skin paddle that would be deemed sufficient in size for the

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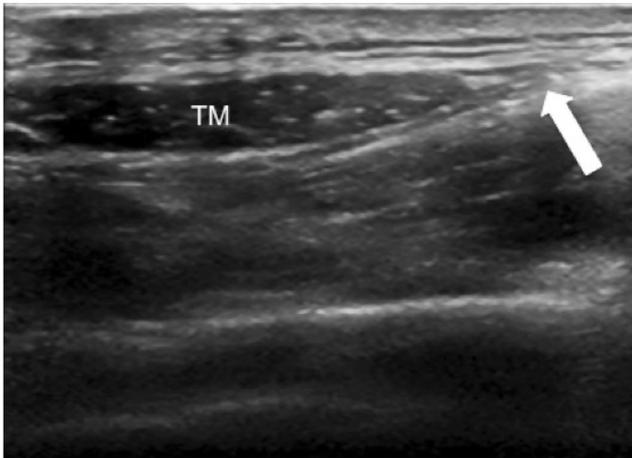


Fig. 1 US appearance of the trapezius muscle (TM) and its inferior border (arrow)

presumed defect was then marked over the muscle by placing its inferior edge at the inferior edge of the TM, which was accurately localized by ultrasonography. In order to identify the precise location of the inferior border of the TM that has been marked on the skin on the day of surgery; the distances between the prominent spinous process of the 7th cervical vertebra (point A in Fig. 2) and the intersection points of the inferior TM border with the medial scapular edge (point B in Fig. 2) as well as the spinous process of the thoracic

vertebra (point C in Fig. 2) were measured with a metric ruler (Fig. 2). These distances were used on the day of surgery to identify the same course of the muscle border defined by US previously. All skin markings were made with the patient on the sitting position both on the day of US exam and on the day of surgery.

Case presentation

A 79-year-old female with a moderately differentiated squamous cell carcinoma involving the right ear and external ear canal was offered reconstruction with a LTIF preoperatively to spare a free flap reconstruction, following radical resection of the tumor in the form of right partial auricectomy and lateral temporal bone resection with right superficial parotidectomy and neck dissection. The patient underwent US-assisted imaging and marking procedure preoperatively for the TM as explained above. The inferior border of the TM was marked on the patient's skin on the day of surgery in sitting position, based on preoperative measurements obtained with US assistance. This marking of the inferior edge of the TM corresponded exactly to the course of the muscle edge, intraoperatively (Fig. 3). The pedicle length determined by the help of this technique was



Fig. 2 Preoperative markings of the spinous process of 7th cervical vertebra (A), inferior border of the TM (BC line), and its intersection points with the medial border of the scapula (B) and spinous process of the thoracic vertebra (C)

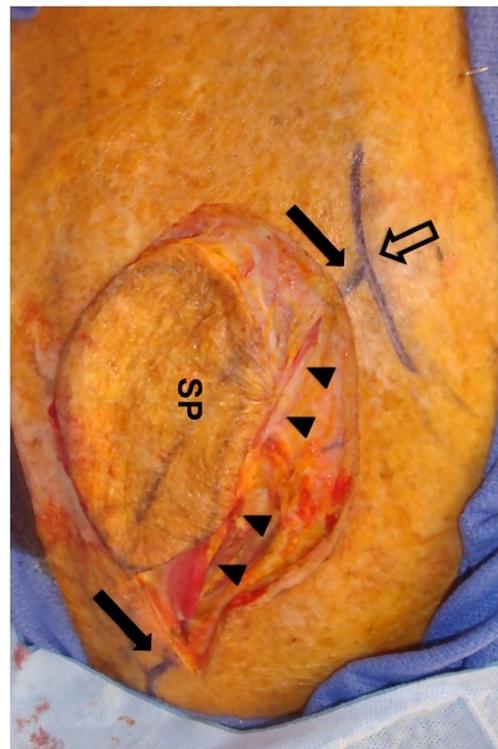


Fig. 3 US-assisted markings of the inferior border of TM (solid arrows), the edge of the TM (arrow heads), open arrow (scapular edge), and the SP (skin paddle)

Fig. 4 The views of the flap after the inset showing adequacy of the pedicle length (**a**) and the viability on the ninth postoperative day (**b**)



observed to be sufficient for the recipient area during surgery (Fig. 4a) and the flap was viable in the postoperative period (Fig. 4b).

Discussion

Contemporary reconstruction of large and/or complex head and neck defects frequently necessitates utilization of microvascular free tissue transfer techniques. However, pedicled regional flaps still have an important role in the reconstruction of head and neck defects, especially in cases where free tissue transfer is not feasible or possible [4]. LTIF is one such pedicled flap that has been successfully used for the reconstruction of a wide variety of head and neck defects [1, 4, 5]. As in any other pedicled musculocutaneous flap, sufficiency of its pedicle length and its muscle bulk may be questionable, when LTIF is considered as the choice of reconstruction of any given defect. Preoperative US-assisted definition of the inferior border of the TM and marking it may help surgeons to accurately design LTIF in terms of placing the skin paddle over the TM in its entirety where a muscle bulk is desired under the entire skin paddle as well as to provide preoperative information on the pedicle length.

Although it is known that skin paddle can extend beyond the inferior edge of the muscle in LTIF reconstruction, this practice may decrease the number of captured perforators within the skin paddle. The technique described herein may also assist the surgeon to place the skin paddle as high as possible, in order to make sure that perforators are captured, especially if visualizing the perforators of TM in Doppler mode is incorporated [6]. This technique may help

maximizing both underlying muscle bulk and pedicle length during flap design by knowing the exact location of the inferior border of TM. However, the effect of this technique's on-flap viability is unknown and needs to be further investigated.

Compliance with ethical standards

Funding There is no funding involved in this article.

Conflict of interest The authors, Emre Vural, MD; Santiago Gonzalez, BS, BA; Mauricio Moreno, M.D.; Teresita Angtuaco, MD; and Donald Bodenner, MD, PhD, declare that they have no conflict of interest.

Patient consent This article contains studies with human participants. Informed consent was obtained from all individual participants included in the study.

Ethical approval For this kind of study formal consent from a local ethics committee is not required.

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