5th Rib Osteo-pectoralis Major Myocutaneous Flap—Still a Viable Option for Mandibular Defect Reconstruction

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Abstract Reconstruction of mandible is of paramount importance following ablative surgery for oral cancer. Though osteocutaneous micro-vascular free flap is generally accepted to be the mainstay of mandibular reconstruction, other reconstructive options are also done for mandibular reconstruction with good results. Seventeen patients of oral cavity cancer involving the alveolus who had underwent hemi-mandibulectomy were reconstructed using 5th rib osteo-pectoralis major myocutaneous flap. Procedure related pleural tear occurred in 3 patients during harvesting of the rib which were repaired intra-operatively with no post-operative complications. There were 2 failures in our series, in the rest 15 patients the flap had taken up; have good oral continence taking semi-solid diet and have satisfactory cosmetic appearance. This study shows that 5th rib osteo-pectoralis major myocutaneous flap is a quick, easy to learn, one stage reconstructive procedure with a good predictable cosmetic and functional outcomes.

Keywords Oral cancer · Hemi-mandibulectomy · Fifth rib osteo-pectoralis major myocutaneous flap

Introduction

Reconstruction of mandible is of paramount importance for rehabilitation of the patient following ablative surgery for oral cancer because interruption of the oro-mandibular continuity disrupts both the form and the function of the mandible [1, 2]. Although a challenge for the head and neck reconstructing surgeon, the reconstruction of oro-mandibular defect is now reliable and successful with excellent long-term functional and aesthetic outcomes. Osteocutaneous micro-vascular free flap alone or in combination with another soft-tissue free flap is generally accepted to be the mainstay of mandibular reconstruction [3–8]. Other reconstructive options are also done for mandibular reconstruction with good result [9]. The optimal reconstruction of mandibular defects is still debated. We need to understand that following resection of the mandible, the restoration of bony continuity alone should not be considered as the measure of success, but also its function including oral competence must be taken into account. Many reconstructions restore mandibular continuity and provide good cosmetic results, but fail to achieve a functional result. Study have shown that mucosal resection is the factor that has the greatest impact on the resultant postoperative oral function [10]. Using stringent criteria for success, the majority of oral cancer appeared to benefit little from aggressive reconstruction of the mandible [10, 11]. Patients with carcinoma of the oral cavity are usually heavy smokers and are predisposed to atherosclerotic disease and other co-morbid conditions, and in these patients micro-vascular surgery may be an ill advice. The

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purpose of this study was to determine the outcome and discuss the advantages of the 5th rib osteo-pectoralis major myocutaneous flap which we still consider a good option and has a place even in the era of free flap in appropriate patients.

Method and Result

Fibular free flap is done in our centre for mandibular reconstruction, but in the above 17 patient's free flaps were not planned due to associated co-morbid conditions and in 3 patients it was because of the previous irradiation. There were 8 males and 9 females. The surgeries were performed by the same surgeon. Only patients who had undergone hemi-mandibulectomy were included in the study. 5th rib was harvested in continuity with pectoralis major muscle. The sternal end of the rib was used towards the anterior medial defect. There were some modifications in our last cases where the sternal end of the rib was harvested up to the costochondral joint as shown in Fig. 1 to give a bigger bony wide with more curve and we found this modification gave more contour to the resected side arch of the mandible. This is important for anteriorly located tumors where resection have to cross midline to include the opposite side of the mandible. With this modification the contour of the arch is well maintained even when part of the opposite side arch of the mandible has to be sacrificed. Figure 2a (post-operative intra oral view of the flap) and Fig. 2b (external view of the patient) show a patient who had undergone left side hemi-mandibulectomy along with resection of a part of the right side arch of mandible. Regarding angle of the mandible, greenstick fracture was done and contours to the required curve and fixed to the preserved condyle. Greenstick fracture can easily be done in cases of the rib without compromising its vascularity. The length of the rib was increased laterally and harvested as per the need of the length required. Pleural tear occurred in 3 patients during harvesting of the rib and were repaired intra-operatively with no post-operative complications. No patients had any procedure related complications in the chest. Figure 3 shows skin incision overlying the 5th rib. The wide of the skin can be adjusted depending on the mucosal defect. Figure 4 shows intra-operative view of the rib been fixed to the opposite mandible in the mid-line anteriorly following right side hemi-mandibulectomy.

Fifteen patients had completed post-operative radiotherapy and there were no any post-operative radiotherapy related complications. Ten patients have completed more than 2 years follow up. One patient died following recurrence of the tumor. Rests of the patients are on follow up. All the patients have good oral continence, taking semi-solid diet and all have satisfactory cosmetic

Fig. 1 Intra-operative view of medial end of harvested rib with muscle and skin attached to it

Fig. 2 a Intra-oral view of the flap. b External view of the patient

Fig. 3 Skin incision

Fig. 4 Intra-operative view of the rib been fixed to the opposite mandible

Fig. 5 **a** Good alignment of the upper and lower jaw. **b** X-ray of the reconstructed mandible on the right side

appearance. Figure 5a shows a patient on follow up, showing good jaw alignment with good aesthetic appearance and Fig. 5b shows X-ray of the same patient at more than 1 year after the treatment. There were two failures in our series. These failures occurred in our earlier cases. In the first case, the rib had to be removed because of the complete necrosis of the pectoralis major-skin paddle over the rib bone. In the second patient, there was a partial necrosis of the pectoralis major-skin paddle for which the patient had to re-undergo local advancement flap to close the defect. This patient had underwent through and through skin defect reconstruction using 5th rib osteo-pectoralis major myocutaneous flap.

Discussion

Reconstruction of composite defects of the mandible following ablative surgery for oral cancer is a challenge. The most common indication for mandibular reconstruction is following mandibular resection for the oral cancer [12, 13]. Majority of oral cancers are in advanced stage and even today the 5 years survival rate for advanced oral cancer is not more than 40 %. There are many reconstructive options, from alloplastic bone substitutes to autogenous bone grafts; but the best suited reconstructive option for a particular patient is critical for the restoration of the mandibular form and function. The aim of mandibular reconstruction should achieve the facial contours, and oral competence including deglutition so that the patient can return to their previous state of function. The ideal reconstructive procedure should be able to give the anatomical, functional and aesthetic aspects of the mandible and at the same time it should be safe, reliable, predictable, single stage procedure with minimal morbidity and no mortality. Use of rib graft has been questioned owing to the problem of high bone resorption rate [14, 15]. Bony resorption is not only a problem for the rib graft but also for the free composite flaps, though the problem may be less [16, 17]. Earlier studies have shown that when the rib is harvested together with pectoralis major as 5th rib osteo-pectoralis major myocutaneous flap, the problem of rib resorption is minimised [12, 19, 20]. Our study series re-enforced the earlier studies. In all 17 patients whose mandible were reconstructed using 5th rib osteo-pectoralis major myocutaneous flap, there were neither rib resorption nor fracture though the follow up is too short to comment. As pointed out by Banerjee and Westmore [18] even if the rib is resorpted the function and cosmesis does not deteriorate. It is thought that once the contour of the mandible has been secured, the fibrosis in the tissues surrounding the bone graft acts to maintain its shape. Previous studies had criticized 5th rib osteo-pectoralis major myocutaneous flap because of the Pulmonary complications associated with this procedure [20, 21]. But in our series we did not encounter any such problem in any of our patients. Pulmonary complication occurs because of pleural tear which can occur during harvesting of the rib. Though there were 3 pleural tear in our study, the patients did not have any pulmonary complication. If dissection is done under direct vision using periosteal elevator and rib respirator, the pleural tear can be easily avoided. Pulmonary embolism is known to occur with free flap procedure [14] but it is not known to occur with 5th rib osteo-pectoralis major myocutaneous flap. The only disadvantage of 5th rib osteo-pectoralis major myocutaneous flap is osseointegrated dental implants cannot be done. But truly to our experience very few patients can or are willing for osseointegrated dental implants.

Fifth rib osteo-pectoralis major myocutaneous flap is a one stage reconstructive procedure producing a more rapid rehabilitation of the oral cavity. The procedure is quick and does not need a separate reconstructing team as in our case where the same surgeon did the reconstruction. Unlike micro-vascular free flap, 5th rib osteo-pectoralis major myocutaneous flap reconstruction is quick with an average time of 1 h to raise and place the flap. Post-operative radiation therapy does not cause any problem to this flap. Complication rates are negligible. No serious complications were noticed in any of our patients. In 3 of our patients, pleural tear occurred which were successfully repaired intra-operatively with no post-operative complications. Though there were two failures in our series, but with familiarity of the procedure the failures can be easily overcome unlike micro-vascular surgery where the margin of success and failure is narrow. Thus, the advantages of 5th rib osteo-pectoralis major myocutaneous flap are: short learning curve, short time to perform, micro-vascular surgery is avoided, no serious procedure related complications and with familiarity of the procedure failure can be easily avoided with predictable outcome.

Conclusion

Although micro-vascular fibular free flap is considered the gold standard for reconstruction of mandibular oncologic defects, our results show that 5th rib osteo-pectoralis major myocutaneous flap still has a place in selected patients especially in elderly patients, advanced oral cancer, heavy smokers with co-morbid conditions or in whom Doppler study shows atherosclerotic changes in the vessels and in post irradiated patients. This procedure may also be a good option in centres where the bulk of patient is high. Hence, 5th rib osteo-pectoralis major myocutaneous flap can give a good predictable cosmetic and functional outcome with almost no failure and complications.

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