

Free bipaddled anterolateral thigh flap for simultaneous reconstruction of large larynx and prelaryngeal skin defects after resection of the local recurrent laryngeal cancer invading the cricoid cartilage and prelaryngeal skin

A case report

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Abstract

Rationale: After total or near-total laryngectomy and resection of prelaryngeal skin, laryngeal defects and prelaryngeal skin defects often remain a great challenge for head and neck surgeons when considering simultaneous reconstruction of. In this case report, a free bipaddled anterolateral thigh (ALT) was used for such defects reconstruction.

Patient concerns: For this 50-year-old male patient whose recurrent tumor invaded the cricoid cartilage and the prelaryngeal skin, supracricoid partial laryngectomy with a cricohyoidepiglottopexy would no longer be an option. However, the patient had a strong requirement of preserving lung-power speech, making total laryngectomy and chemoradiotherapy not acceptable.

Diagnosis: Pathologic result demonstrated well-differentiated squamous cell carcinoma. A PET-CT of the whole body showed extralaryngeal extension of the tumor invading the cricoids cartilage and prelaryngeal ribbon muscles and skin. Meanwhile, the videolaryngoscopy showed smooth laryngeal mucosa.

Interventions: A near-total laryngectomy and resection of prelaryngeal skin were performed. The resultant defects were reconstructed with a free bipaddled ALT flap.

Outcomes: The patient is 18 months postsurgery with no locoregion tumor recurrence, taking oral feeds, partial lung-power speech and not decannulated. Laryngostenosis was shown by the videolaryngoscopy, MRI and CT scan.

Lessons: A free bipaddled ALT flap could be utilized for simultaneous reconstruction of large larynx and prelaryngeal skin defects, and allows partial laryngeal function preservation in selected local recurrent laryngeal cancer invading the cricoid cartilage and prelaryngeal skin.

Abbreviations: ALT = anterolateral thigh.

Keywords: cricoid cartilage invasion, free bipaddled anterolateral thigh flap, local recurrent laryngeal cancer, prelaryngeal skin invasion

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Informed written consent was obtained from the patient for publication of this case report and accompanying images.

The authors declare that they have no conflicts of interest.

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1. Introduction

For recurrent laryngeal cancer patients with laryngeal cartilage invasion, laryngeal function preservation surgery is often not considered.^[1,2] Therefore, chemoradiotherapy and total laryngectomy are the main treatment choices for these patients. However, patients who had received a total laryngectomy, would lose speech lung-power function and maintain permanent stoma.

It is well-known that the goal of laryngeal cancer therapy is to control the disease while still reserving swallowing and speech functions.^[3] In order to achieve partial laryngeal function, in the case of ensuring tumor margins negative, a near-total laryngectomy, rather than total laryngectomy, could also be considered as a treatment option for recurrent laryngeal cancer patients with cricoid cartilage invasion and pre-laryngeal skin invasion. However, simultaneous reconstruction of laryngeal defects and prelaryngeal skin defects is a great challenge for head and neck surgeons. Here we present a case where we successfully used a free bipaddled anterolateral thigh (ALT) for simultaneous reconstruction of large larynx and prelaryngeal skin defects

after near-total laryngectomy for local recurrent laryngeal cancer invading the cricoid cartilage and prelaryngeal skin.

2. Case report

A 50-year-old male underwent CO₂ laser ablation for bilateral vocal cord leukoplakia in the local hospital 8 years ago. 6 years later, the patient was again referred to the local hospital for difficulty breathing and underwent an emergency tracheotomy and laryngeal neoplasm biopsy indicating squamous cell carcinoma, and then the patient received vertical frontal partial laryngectomy. However, gradually enlarged neck mass and repeated neck infections were found 6 months postoperatively. In order to seek for further diagnosis and therapy, the patient was referred to our department and underwent neck mass biopsy. Pathologic result demonstrated well-differentiated squamous cell carcinoma. A PET-CT of the whole body showed extralaryngeal extension of the tumor invading the cricoids cartilage and prelaryngeal ribbon muscles and skin (see Fig. 1). However, the video-laryngoscopy showed smooth laryngeal mucosa. A multi-disciplinary team (MDT) discussion was conducted from department of head and neck surgery, department of head and neck oncology, department of radiology and department of pathology, and it was suggested that a radical surgical resection of tumor should be performed first, and then chemoradiotherapy should be also utilized to improve the locoregional control rate.

The patient underwent a preoperative assessment of the descending branch of lateral femoral circumflex vessel and its perforator vessels with Doppler ultrasound imaging and MRI of the lower limb blood vessels with 3-dimensional reconstruction. Following a tracheostomy under local anesthesia, a general anesthesia was performed. As shown in Figure 2, the tumor was removed completely, together with thyroid cartilage, anterior half of cricoid cartilage, bilateral vocal cord, bilateral ventricular bands, bilateral laryngeal ventricle, part of the epiglottis,

prelaryngeal ribbon muscles, and skin. As a result, the anterior part of larynx was excised completely as for a near-total laryngectomy, only the upper part of epiglottis, the posterior part of cricoid cartilage and bilateral arytenoid cartilage were preserved. Tumor-free margins were confirmed by intra-operative frozen sections. Then bilateral regional neck lymph node dissection was conducted. During the procedure, the available recipient vessels were carefully identified and preserved, because these vessels might then be used for microvascular anastomosis.

To simultaneously repair the defects of the larynx and prelaryngeal skin, a free bipaddled ALT flap was harvested as shown in Figure 3. While harvesting flap, the descending branch of lateral femoral circumflex vessel and its perforator vessels were carefully identified and preserved. The actual size of the harvested ALT flap was determined by the size of the larynx and prelaryngeal skin defects. According to different perforator vessels and targeted skin defect sizes, the harvested ALT flap (12 cm × 6 cm) was divided into two flaps including a smaller flap (4 cm × 6 cm) and a larger flap (8 cm × 6 cm), which were used for reconstruction of the larynx and prelaryngeal skin defects, respectively.

Once the cervical recipient vessels, including superior thyroid artery, superior thyroid vein and common facial vein, were prepared, the free bipaddled ALT flap was transferred to the defect site. As shown in Figure 4, the smaller flap was initially sutured to the residual laryngeal mucosa, followed by microvascular anastomosis, during which 1 artery and 2 veins were anastomosed. Finally, the larger flap was sutured to the cervical skin. Thigh wound was sutured directly. Antibiotic medications and anticoagulant were used postoperatively.

The free ALT flap survived well postoperatively. The patient slowly started on a semisolid diet orally without aspiration 7 days postoperatively. One month postoperatively, the patient underwent 3 cycles of chemotherapy with cisplatin and 5-fluorouracil, and radiotherapy to the primary tumor and the neck. The patient

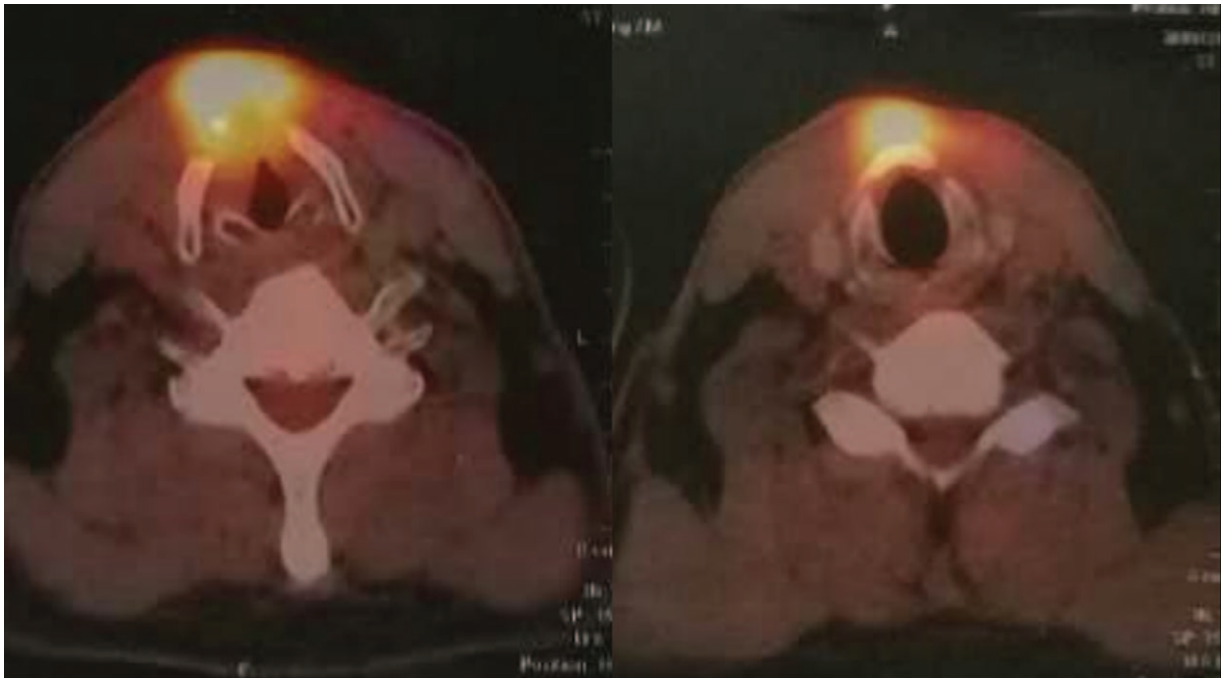


Figure 1. Preoperative PET-CT scan showing tumor with the cricoids cartilage and prelaryngeal skin invasion.

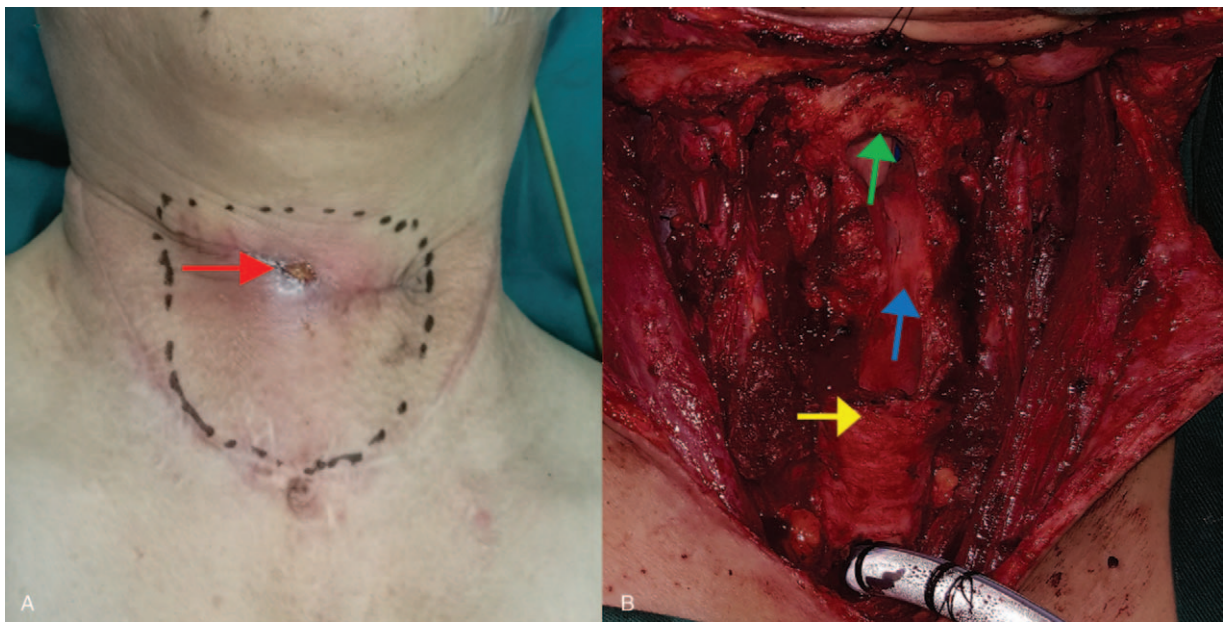


Figure 2. Tumor resection. A: Surgical incision design. B: Tumor resection. The red arrow indicates the neck infection fistula, the yellow arrow indicates the first tracheal cartilage, the blue arrow indicates the Inter-arytenoid region and the green arrow indicates the epiglottic cartilage.

is now 18 months post-surgery and is consuming a normal diet orally. In addition, lung-power speech function is restored partially. An MRI and CT scan at the end of 18 months post-surgery shows that laryngostenosis but no locoregional tumor recurrence are observed (see Fig. 5). At the same time, the video-laryngoscopy at the end of 18 months post-surgery also shows laryngostenosis (see Fig. 6). As a result, the tracheostomy tube could not be removed.

3. Discussion

For local recurrent laryngeal cancer after transoral laser microsurgery or vertical frontal partial laryngectomy, supracricoid partial laryngectomy, total laryngectomy, and chemoradiotherapy are the main therapeutic selections.^[2,4,5] Supracricoid partial laryngectomy is an effective therapeutic alternative to total laryngectomy for local recurrent laryngeal cancer, and could preserve laryngeal functions including lung-

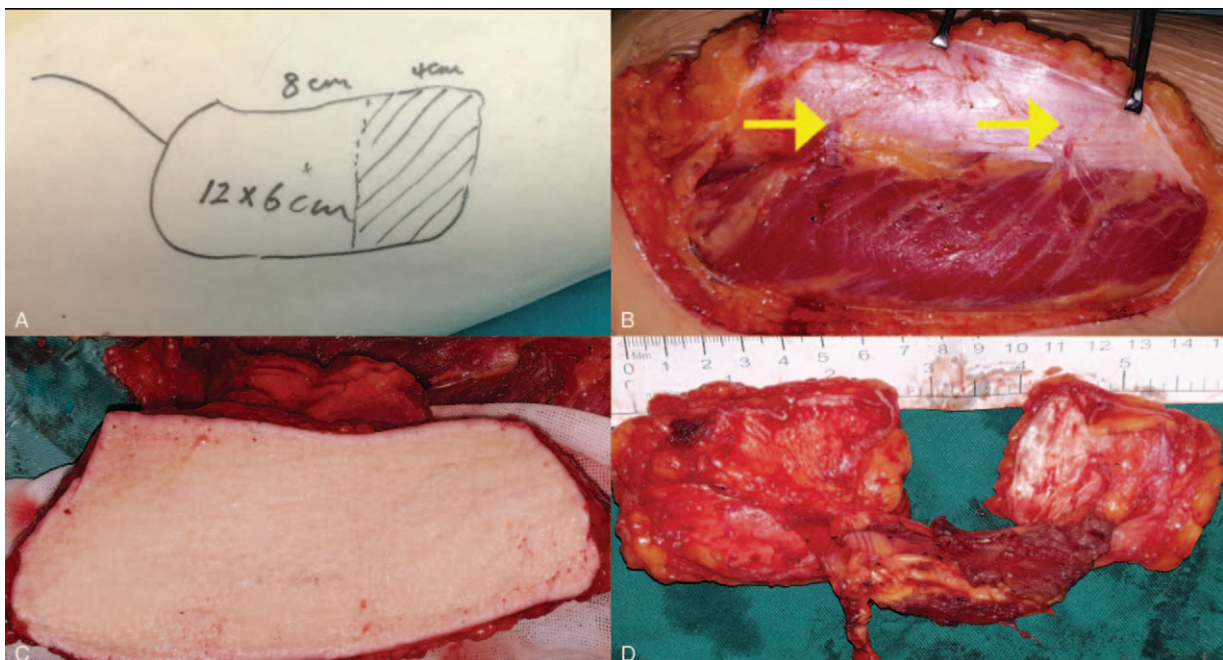


Figure 3. Harvesting of the free bipaddled anterolateral thigh (ALT) flap. A: Design of the bipaddled ALT flap. B: Exposure of the fasciocutaneous perforators from the descending branch of the lateral circumflex femoral artery. C: Harvesting of the ALT flap. D: Harvesting of the bipaddled ALT flap. The yellow arrow indicates the fasciocutaneous perforators from the descending branch of the lateral circumflex femoral artery. ALT = anterolateral thigh.

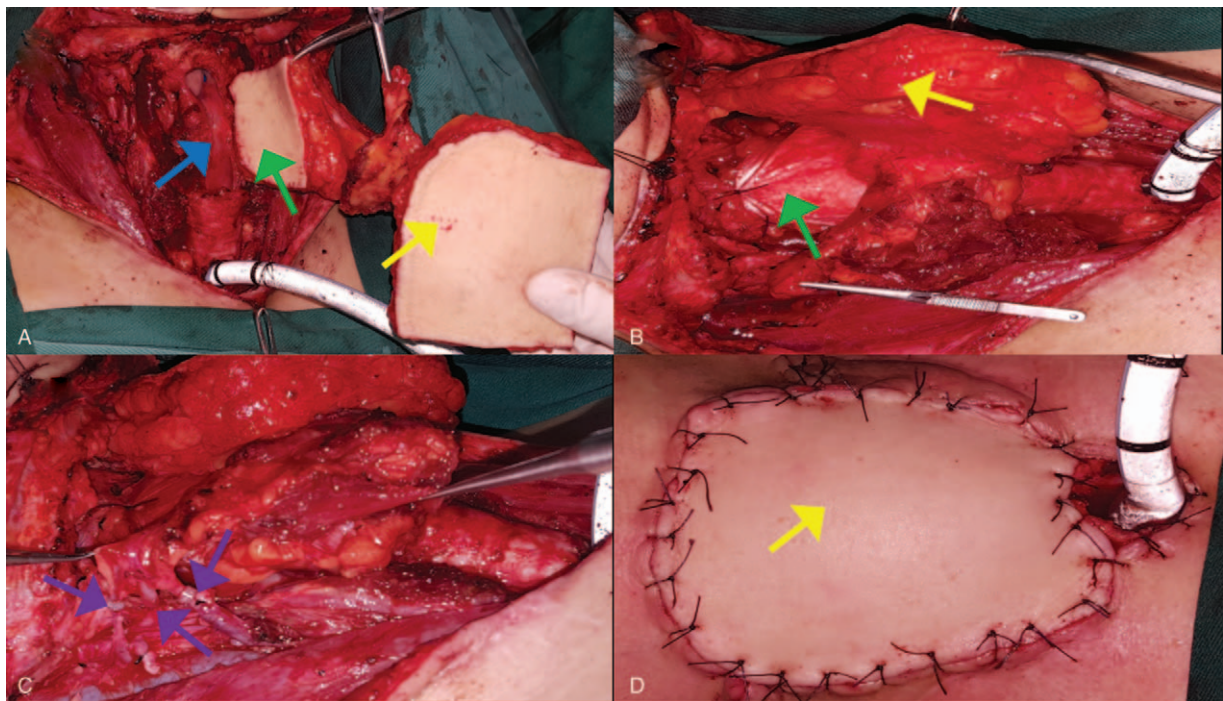


Figure 4. Simultaneous reconstruction of large larynx and prelaryngeal skin defects with the free bipaddled anterolateral thigh (ALT) flap. A and B: The reconstruction of the larynx defect with the smaller flap from the free bipaddled ALT flap. C: Microvascular anastomosis. D: The reconstruction of the prelaryngeal skin defects with the larger flap from the larger flap from the free bipaddled ALT flap. The blue arrow indicate the residual laryngeal structure, the green arrow indicates the smaller flap from the free bipaddled ALT flap, the yellow arrow indicates the larger flap from the free bipaddled ALT flap, and the purple arrow indicates the anastomosed vessel. ALT = anterolateral thigh.

power speech and swallowing and avoid a permanent stoma. However, it is worthy of noting that strict indications are conducted for a supracricoid partial laryngectomy, without cricoid cartilage invasion, hyoid bone invasion, extra-laryngeal space spread or bilateral fixed arytenoids.^[5]

This patient whose recurrent tumor invaded the cricoid cartilage and the prelaryngeal skin would be excluded for a

supracricoid partial laryngectomy with a cricohyoidepiglotomy. Total laryngectomy and chemoradiotherapy would often be therapeutic options under these circumstances. However, the patient had a strong requirement of preserving lung-power speech and our MDT discussion suggested that a radical tumor surgical resection would be followed by a chemoradiotherapy. According to the extent of tumor, a near-total laryngectomy and

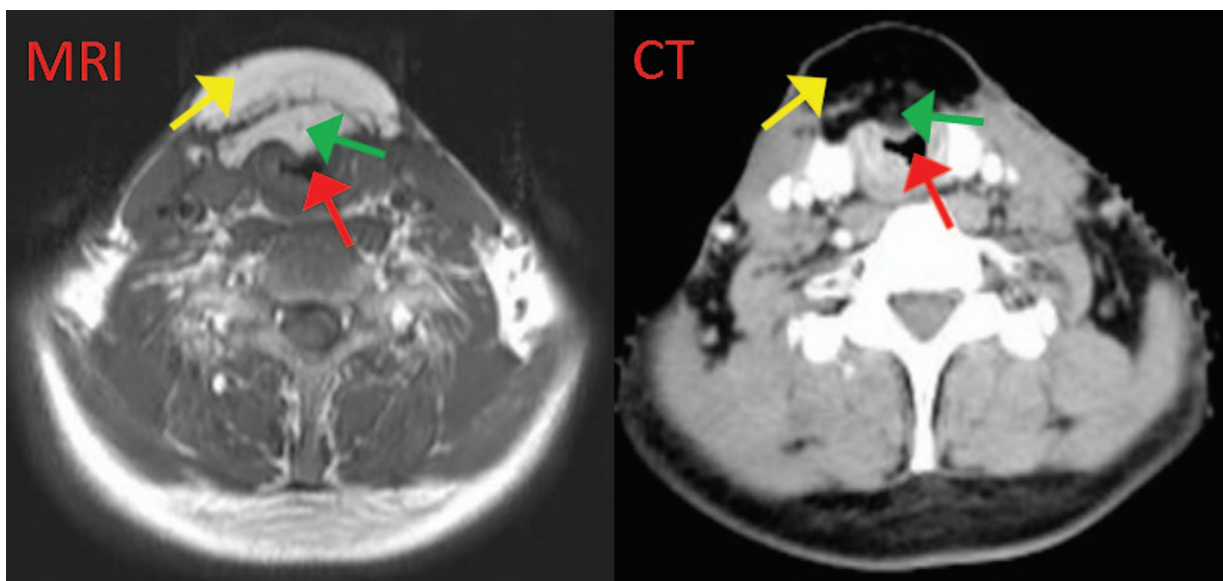


Figure 5. Postoperative MRI and CT scan at the end of 18 months. The yellow arrow indicates the larger flap from the free bipaddled ALT flap, the green arrow indicates the smaller flap from the free bipaddled ALT flap and the red arrow indicates the narrow laryngeal cavity. ALT = anterolateral thigh.



Figure 6. Postoperative video-laryngoscopy at the end of 18 months.

the resection of pre-laryngeal soft tissues and skin were performed with tumor-free margins. It is a great challenge to reconstruct the huge defects of larynx and pre-laryngeal skin.

It is well-known that ALT is a large skin flap based on multiple musculocutaneous or fasciocutaneous perforators from the descending branch of the lateral circumflex femoral artery,^[6] which allows the flap to be harvested with two or more paddles according to its perforators.^[7] Therefore, a free bipaddled ALT flap containing 2 fasciocutaneous perforators was utilized to achieve simultaneous reconstruction of large larynx and pre-laryngeal skin defects in our study. In addition, the donor site could be sutured directly without conspicuous donor site morbidity.

During the follow-up period, no locoregion tumor recurrent and distant metastasis was observed, and swallowing and lung-power speech functions were restored partially. However, completely breathing via nose and mouth could not be achieved because of the laryngostenosis, which might be associated with loss of cartilage support and thick subcutaneous tissue of the free bipaddled ALT flap. Compare with a free ALT flap, a free radial forearm flap and a free posterior tibial flap can provide thinner skin flap.^[8] Therefore, if a free bipaddled radial forearm flap or a free bipaddled posterior tibial flap was utilized, it would be possible to reduce the risk of laryngostenosis. However, this

disadvantage could be quite acceptable considering that an ALT flap can provide much larger skin flap than that a radial forearm flap and a posterior tibial flap. Furthermore, with the development of 3D printing technology, 3D printing laryngeal cartilage support might help to reduce the risk of laryngostenosis in the future.

In conclusion, a free bipaddled ALT flap could be utilized for simultaneous reconstruction of large larynx and pre-laryngeal skin defects, and allows partial laryngeal function preservation in selected local recurrent laryngeal cancer invading the cricoid cartilage and pre-laryngeal skin. However, prospective studies with a larger sample size are required to substantiate our findings.

Author contributions

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