to the hospital during the entire follow-up period. All patients reported that they were satisfied and would choose surgery again. Overall satisfaction with the procedure was extremely high (9.5 ± 1.0), and satisfaction ratings for resting and exertional dyspnea were also high (9.7 ± 0.5 and 9.5 ± 1.0, respectively). Symptoms of recurrence at follow-up were extremely low (0.6 ± 1.4 out of 10). Dramatic improvements were observed between subjectively reported symptoms before and after cricoplasty.

Tailored cricoplasty is an effective technique to improve the outcome of reconstructive subglottic stenosis in the short and medium term. It offers reconstructive possibilities for patients previously considered to be the most challenging subset of those with subglottic stenosis.

References


Discussion

Dr Erino A. Rendina (Rome, Italy). First, I congratulate you on an excellent experience. Eighteen tailored cricoplasties in 15 months is an outstanding experience, and the results are very good.

In your series, predictably, the vast majority of patients had idiopathic subglottic stenosis. These patients are the most difficult to treat, and they are notoriously vulnerable to recurrence. This type of stenosis is usually short, and although I concur with the prudential measure of keeping the patient’s neck flexed for 1 week, as stated in the article, this entailed a lack of release maneuvers in your series. Despite the idiopathic nature of the stenosis, you did not have any remarkable complication or recurrence, and this is an exceptional achievement. The only postoperative problems arose from mucosal edema, which might be of particular severity at such a high airway location, as stated in your article.

I have three questions. First, your modification consists of enlarging the airspace laterally, whereas the classical repair, the Pearson repair, prescribes the posterior resection of the cricoid plate beneath the mucosa. How often were both enlargement techniques needed simultaneously to obtain an adequate airspace?

Dr Liberman. Thank you for your comments. In terms of getting the posterior cricoid plate exposed and removing thickened tissue, I don’t have the exact numbers for this experience, but it’s done approximately half the time. For most of these patients, as we said, the issue is that the stenosis is high and they have a severe side-to-side narrowing. The anteroposterior dimension is quite easy to fix. Once you remove the anterior portion of the cricoid, your anteroposterior dimension is improved. We have no hesitation in removing the posterior cricoid plate and resurfacing that, however, which is much simpler than fixing the side-to-side narrowing.

Dr Rendina. You stated that you extubate your patients in the operating room at the end of the procedure, yet you mentioned in your article that in one case emergency reintubation was required for sudden mucosal edema. Our habit at my institution is to keep the patient intubated, fully awake, under spontaneous breathing, with the tube uncuffed for 24 hours. This may be unpleasant for the patient but may minimize the effect of early mucosal edema. In addition, you do not administer steroids routinely in the postoperative period, yet you were occasionally obliged to institute steroid therapy for acute causes. On the basis of this experience, would you now consider some kind of early postoperative airway protection and routine steroid prophylactic therapy for these high airway procedures? Thank you again, and congratulations.

Dr Liberman. Thank you. I’ll start with the endotracheal intubation question. We do not routinely keep patients intubated postoperatively, whether with the cuff up or down, and have found little problem with that. Of our 2 patients with airway complications, one of those patients was reintubated. The patient did very well after surgery, and at 7 postoperative days had an allergic reaction to a new shampoo in the shower. The patient had a difficult airway and because of that was reintubated in the intensive care unit. The patient was actually preparing to go home the day that the event occurred. The patient had undergone bronchoscopy that day in the operating room just to look at the anastomosis, which we do on day 7 for all patients, and the anastomosis was fine. The shower took place later that day. The patient had to be reintubated over a bronchoscope. That was her issue. So I don’t think that that was necessarily related to edema, as opposed to an anaphylactic reaction in the airway.

The other patient had postoperative mucosal edema and was treated with intravenous steroids and did not need reintubation. Probably having a tube placed in that patient would have been safer; however, she was able to get by without it. We do not routinely use endotracheal intubation for fear of irritating the anastomosis, and we rarely see airway complications in these patients. This series
constitutes only the 18 tailored cricoplasties that were performed during that 15-month period. Another 30 or 40 patients underwent subglottic resections without cricoplasty during that period, and none of those patients required either steroids or intubation.

**Dr Joel D. Cooper (Philadelphia, Pa).** I enjoyed the article; it explained something that I have not quite understood before. I’ve had the same experience since coming to Philadelphia, I think that in the last 18 months there have been about 20 laryngotracheal resections, with 15 or 14 for idiopathic stenosis. I would have to disagree that the usual narrowing is anteroposterior. The picture you showed me is the absolutely typical, usual concentric narrowing of the idiopathic subglottic stenosis, and I have not seen one case of narrowing that wasn’t circumferential, where it was front to back. So I really believe that that is typical.

What I now understand, and the question I will ask, when Dr Pearson described this operation, and I was fortunate to be tagging along at the time, the operation that he described uses either a rongeur or a dental burr to take out the posterior cricoid plate, saving the posterior perichondrium, adding a tremendous amount of increased diameter. Part of that procedure is to go right up the sides, as you described doing separately, and take out the cartilage, leaving the perichondrium, the outer perichondrium. That’s the reason, as Dr Pearson described it, that you advance the entire trachea, either by closing the membranous wall and advancing the entire trachea with a closed membranous wall or usually just by advancing the whole trachea into that space. You have accomplished this by doing what you described here, but doing it posteriorly. Dr Grillo described taking a membranous flap of the membranous trachea, taking off one ring. The difference was, I believe, that he didn’t remount with much circumferentially and therefore advance the mucosal flap for resurfacing, with slightly less advancement of the trachea. So I really think that if you just remount with a burr or a rongeur the posterior plate of the cricoid, and it usually goes up at least halfway around the cricoid to include the areas that you have, you can just very easily then advance the entire trachea as originally described, and I don’t think it has to be selectively just on individuals who are seen to have a side-to-side stenosis. I don’t know if my understanding is correct, but is it correct, by and large, that your standard procedure does not involve removing a great deal of the posterior cricoid plate?

**Dr Liberman.** I would like to go back to the beginning and talk about the radiograph that we showed. I agree that most patients have concentric narrowing; this becomes a problem, however, when you get very high, and we’re talking about at the top of the cricoid as opposed to the lower ones. When it’s at the lower edge of the cricoid, it’s fine, because you don’t need to worry about it as long as you remove the lower part of the cricoid. When you’re up at the larynx or at the thyroid cartilage, however, which is what that radiograph was showing, those patients have really, really high stenosis. Even if you resect the posterior part, because the stenosis is so tight from side to side and is so high, you cannot remove the whole posterior cricoid without compromising postoperative laryngeal function and the recurrent nerves. These are the patients that we’re describing, and maybe I didn’t make that clear, but they are the ones in whom you really need to resect that submucosal thickened tissue, the ones who can’t be helped when approached from below. In terms of the original Pearson procedure and telescoping the trachea up into the area, that is very effective. When you get very, very high, however, in these types of patients you’re limited by the fact that you still have stenosis even after you’ve taken out the anterior cricoid and the posterior cricoid, because the stenosis really continues up to an area that a lot of people would have considered inoperable in the past. They actually have stenosis in the larynx, and by telescoping a piece of trachea up into an already thick and small airway, you would decrease the luminal diameter even more. So those are the patients we’re trying to help with this procedure. We still do the typical procedure, not the Pearson procedure but the Grillo procedure, for the majority of patients, who don’t have that type of disease.

**Dr Paolo Macchiarini (Barcelona, Spain).** Thank you for this interesting new technique. The typical Grillo technique is a wonderful technique, and this seems to be wonderful as well. Would you please, however, describe further the precise indications? In my experience, finding the right plane between the anterior and posterior arch to do the submucosal tailoring is extremely hard. The vast majority of these patients, probably those with known idiopathic stenosis, have a destroyed or almost destroyed cartilage structure, making the plane difficult to find. Should this technique be restricted, as you mentioned as well, to patients with this very high located idiopathic stenosis or the untreated simple postintubation subglottic stenosis? Also, did you ever try for patients with such high stenosis to inject high doses of steroids into the vocal cords either before or after operation avoid any problems?

**Dr Liberman.** First, as to the steroids, we have not given any, and we usually have not seen vocal problems. That would be the answer to the second question. For the first question, we continue to use the typical Grillo technique for most patients. We choose to use the tailored cricoplasty as opposed to the typical Grillo procedure for the patient who does not have a good luminal airway diameter after resection with the Grillo technique. So we’ve done the Grillo procedure, and now the patient still has maybe a 10-mm anteroposterior diameter, but the side-to-side diameter is still 4 mm. Putting it all back together is daunting, as you can imagine. Those are the patients for whom we use this technique. In contrast, if we do the anterior and posterior resections and the opening looks wide, we just sew it back together in the way that was originally described.

With respect to the plane that you were asking about, there is no plane, as you mentioned, and it’s very hard to find the tissue plane. We use a sharp dissection. Actually, we don’t find the plane, we make the plane. The submucosal thickened tissue, as you mentioned, is completely abnormal. There is no submucosal plane. There is no plane between that tissue and the cricoid. We use sharp, slow dissection, taking pieces off 3 to 4 mm at a time, until we feel that the cricoid is not compromised too much. We still have integrity and strength of the cricoid to hold the airway together as well as having an increased luminal diameter. So that’s the answer to that question.