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The 'shark mouth' flap approach for digital glomus tumours in 24 patients: technique and clinical outcomes

Ghada Asmar[1], Tahar Mati[1], Ioana Anastasia Pop[1] and Marc-Olivier Falcone[1,2]

Abstract

This retrospective, single-centre study was carried out on patients with digital subungual glomus tumours. We describe a subperiosteal approach with a 'shark mouth' flap containing the nail plate and nail bed as a single unit, providing ideal exposure and easy access to the tumour. It combines the advantages of the transungual and lateral approaches, whether the subungual tumours are located centrally, peripherally or under the germinal matrix. The 'shark mouth' flap approach was used by the same surgeon in 24 patients with solitary glomus tumours of the fingers. Clinical outcomes at the early postoperative phase and at the last follow-up were satisfactory. Pain relief and wound healing were quickly achieved. No complications, such as fingertip numbness or nail deformities, were observed, and there was only one recurrence. This approach is reliable, nail-sparing and less time-consuming than other techniques.

Level of evidence: IV

Keywords

Glomus tumour, shark mouth flap, subperiosteal approach, subungual, matrix, nail deformity

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Introduction

Glomus tumours of the hand are relatively uncommon (Tuncali et al., 2005). They arise from the neuromyoarterial glomus as a form of abnormal hyperplasia (Ponnelle et al., 1999). Their sole treatment, when located on the digits, is a careful and complete surgical resection (Rettig and Strickland, 1977). Several surgical techniques have been described to approach the tumour depending on its location. The aim is to provide pain relief, as well as to prevent recurrences and nail deformities. Transungual, periungual and lateral subperiosteal techniques are classically employed.

The aim of this report is to describe a variant of the lateral subperiosteal approach that we call the 'shark mouth' flap approach. It was used in 24 patients with glomus tumours of the fingers underneath the sterile and germinal matrices of the nail bed, as well as lateral to it. The clinical outcomes of those who underwent surgery by this approach were assessed.

Methods

This single-centre, single-operator, retrospective, observational study took place between October 2017 and December 2018. The study was approved by our Institutional Review Board. All patients provided written informed consent to participate in the study.

Patients who underwent surgery for a subungual glomus tumour with histological confirmation of the diagnosis were included. Patients underwent surgery between October 2011 and April 2018. Patients who had multiple occurrences of tumours of the glomus

[1]Ramsay Générale de Santé – Capio, Hôpital Privé Paul d'Egine, Champigny-sur-Marne, France
[2]Clinique Internationale du Parc Monceau, Paris, France

Corresponding Author:
Marc-Olivier Falcone, Ramsay Générale de Santé – Capio, Hôpital Privé Paul d'Egine, 4 avenue Marx Dormoy, 94500 Champigny-sur-Marne, France.
Email: falcone.research@gmail.com

body in different fingers, in the confirmed context of multiple glomangiomas or neurofibromatosis, were excluded. Patients were assessed postoperatively by an evaluator (G.A.) who was different from the operator (M.-O.F.). Data collection took place between March 2018 and December 2018. Data were analysed using Microsoft Excel 365 (Microsoft®, Redmond, WA, US). Photographs were obtained using a digital camera before surgery, during surgery and at postoperative follow-up.

Preoperative epidemiological characteristics were collected, including gender, age, profession, dominant side, digit involved, tumour location, history of first symptoms and their change over time. Details of the clinical findings with the different tests performed were recorded. Previous surgery and the presence of bone defects of variable size on plain radiographs or magnetic resonance imaging (MRI) were also noted.

After surgery, data were recorded at two follow-up visits: within 3 weeks of surgery and at least 6 months later. Data collected at the early postoperative phase included wound healing and time to resume work or daily activities. At the final follow-up, the simplified Disabilities of the Arm, Shoulder and Hand Questionnaire (QuickDASH) score was calculated for each patient. Assessment included pain relief on the visual analogue scale as well as the presence of nail deformity. Range of motion (ROM) and sensitivity were also assessed and compared with other digits. Tumour recurrence, if any, was also noted.

Surgical technique

A specialized consultant in hand surgery carried out all the operations. Before anaesthesia, patients were invited to indicate with a marker pen the pinpoint trigger zone on the finger, corresponding to the presumed location of their tumour (Figure 1(a)). The surgeon ensured the marked zone was compatible with his clinical findings and the imaging findings. Surgery was carried out under brachial plexus block in the supine position with an arm tourniquet inflated at 250 mmHg.

If the tumour was located under the germinal or sterile matrix of the nail bed, the skin incision was midlateral on the finger, slightly shifted dorsally towards the nail fold. It was made on one side of the digit and then extended around the fingertip, finally ending on the other side (Figure 1(a) and (b)). The skin was dissected straight to the phalanx. A composite flap containing the skin and nail bed with the nail plate as a unit was elevated in a subperiosteal fashion. The flap, resembling an open 'shark mouth' (Figure 1(c)), was then gently lifted and held with a Gillies skin hook. The flap fully exposed the phalanx and the inferior aspect of the sterile matrix of the nail bed as well as the germinal matrix. The tumour was identified, often as a gelatinous encapsulated mass different in consistency from the surrounding nail bed tissue. The procedure continued with a wide resection to include tumour-free margins. Particular care was taken to ensure no damage was done to the germinal or sterile matrix. The excised tissue (Figure 1(d)) was sent for histopathological examination. Low intensity bipolar electrocautery was then used gently on the tumour feeding vessels arising from the nail bed. The bone cavity containing the tumour, of variable size, was curetted to remove any possible remaining tumour tissue. The surgery site was irrigated profusely and a central perforation was made in the nail plate to drain any potential postoperative subungual haematoma (Figure 1(e)). The flap containing the nail bed and nail plate was then repositioned on the phalanx with simple interrupted sutures of the skin with non-absorbable monofilament 5-0 (Figure 1(e) and (f)). The dressing was simple without immobilization and patients were encouraged to move the digits freely postoperatively.

If the tumour was located strictly laterally to the nail bed, the incision was limited to the relevant side. Thus, only part of the 'shark mouth' flap was dissected and lifted. Tumour resection was carried out in the same fashion as described for central nail bed locations. For lateral tumours, there was no need to perforate the nail plate, assuming there was a limited risk of postoperative haematoma in these cases.

Results

Twenty-four consecutive patients (16 women and eight men) underwent surgery for a solitary digital glomus tumour, with histopathological confirmation of its benign features. The mean age at surgery was 41 years (range 20–70). The series consisted of 20 active workers, two non-working mothers, one retired patient and one university student.

Twenty-three patients were right-handed. The dominant side was involved in 12 patients. The distribution of the tumours is shown in Figure 2. The mean time between the first symptoms and the date of surgery was 7.5 years (range 0.5–21). All patients complained preoperatively of spontaneous paroxysmal radiating pain and a pinpoint trigger zone, and 13 complained of cold hypersensitivity. As part of the preoperative assessment, all patients had plain radiographs and MRI with contrast injection, and all had suggestive findings. This was a first operation for 21 patients.

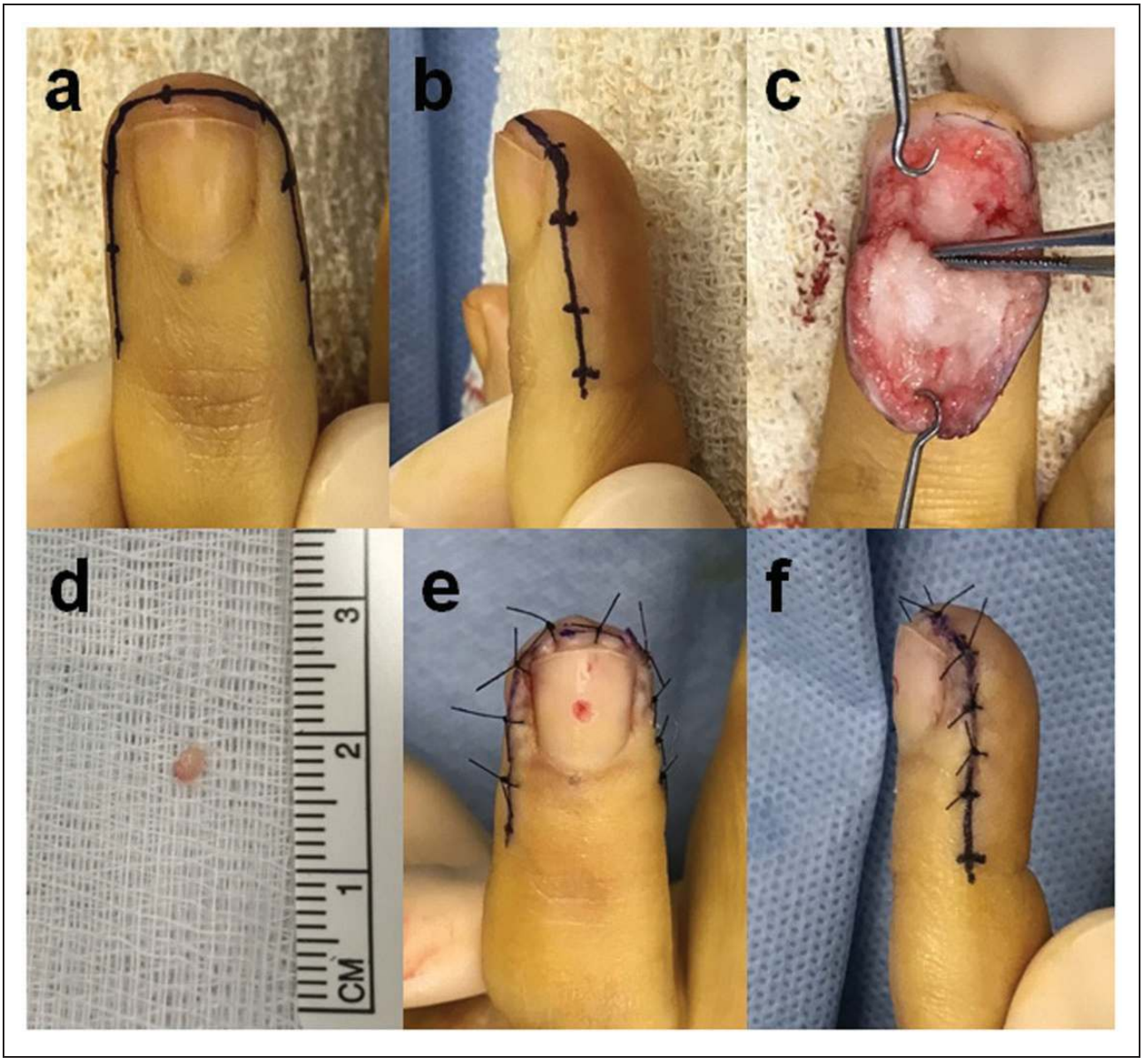

Figure 1. (a) Dorsal and (b) lateral views of the incision. Germinal matrix tumour marked in (a). (c) 'Shark mouth' flap. (d) Excised glomus tumour. (e) Dorsal and (f) lateral views after skin closure and nail plate perforation.

Three had previously undergone surgery by a transungual technique and two of them had residual nail deformity. Nineteen tumours were located under the sterile or germinal matrix. Other preoperative characteristics are summarized in Table 1.

A nail plate perforation was done at the end of the procedure in 17 of the 19 patients with tumours located underneath the sterile or germinal matrix. Bone defects or cavities suspected on plain radiographs or MRI along with small bone impressions discovered during surgery were confirmed in 19 patients.

There were no infections and full wound healing was achieved within 2 weeks for all patients. The mean time to return to regular activities was 16 days (range 0–30).

All 24 patients were reviewed for the late postoperative phase at least 6 months after surgery and none of them was lost to the final follow-up visit. Mean time to last follow-up was 25 months (range 6–77). On the QuickDASH and visual analogue scale evaluations, all patients scored zero. All had complete ROM and normal sensation on the pulp. Eleven patients described slight numbness over the scar when touching it. The residual nail deformity after previous surgery in two patients remained unchanged after the procedure. No new nail deformities were noticed. One patient complained of

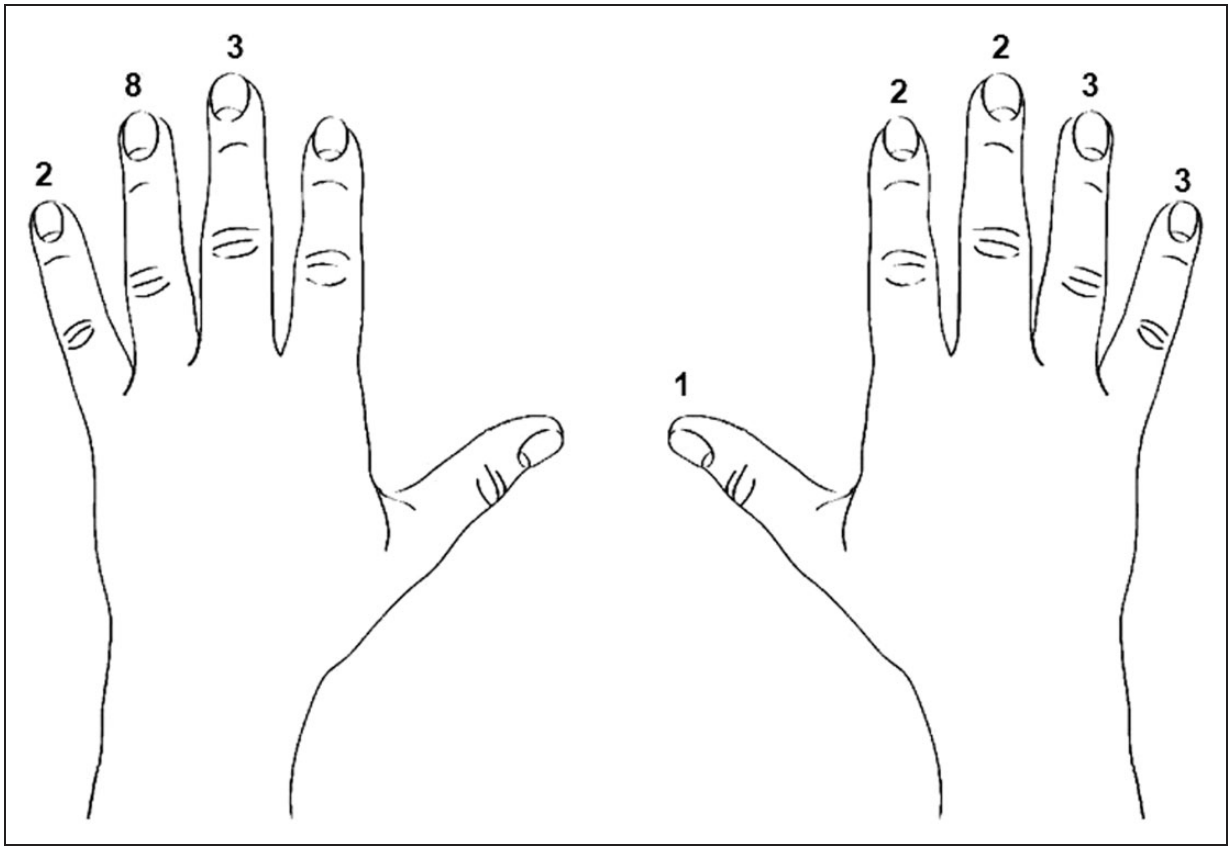

Figure 2. Distribution of the 24 glomus tumours in the fingers of both hands. Two-thirds were located on the ring or little finger.

Table 1. Preoperative characteristics of the patients.

Feature	Total ($n = 24$)
History of trauma	1
Previous surgery	3
Positive tests	
Love's pin test	24
Hildreth's test	12
Nail plate deformity[a]	2
Typical findings on magnetic resonance imaging[b]	24
Subungual location	
Lateral	5
Germinal matrix	4
Sterile matrix	15

[a]Both patients had undergone previous surgery.
[b]Hypo-intense on T1-weighted images and hyper-intense on T2-weighted images and contrast enhanced T1-weighted images.

glomus tumour symptoms again 2 years after surgery. This patient was investigated by MRI and was considered to have a late recurrence. The patient underwent repeat surgery by the same technique with satisfactory results at 1 year of follow-up, and no nail deformity. In two patients, the centrally located subungual tumour was 1 cm in size on MRI underneath the nail bed. Resection of their tumours left a sterile matrix defect 2 mm wide and 3 mm long. No nail bed grafting was done at the end of surgery and healing by secondary intention was achieved while leaving the perforated nail plate in place. Figure 3 shows one of these two tumours. It was located on the right little finger, and was operated on after a 10-year span of typical symptoms. Clinical results at 8 months of follow-up were satisfactory.

Discussion

The only curative treatment for digital glomus tumours is complete resection. Different techniques have been used, depending on the tumour location. Most studies consist of a limited number of patients, with no clear conclusions regarding the best exposure and the optimum approach to avoid recurrence or nail deformity. The classic approaches are lateral (Gandon et al., 1992) and transungual (Van Geertruyden et al., 1996), with variations for each.

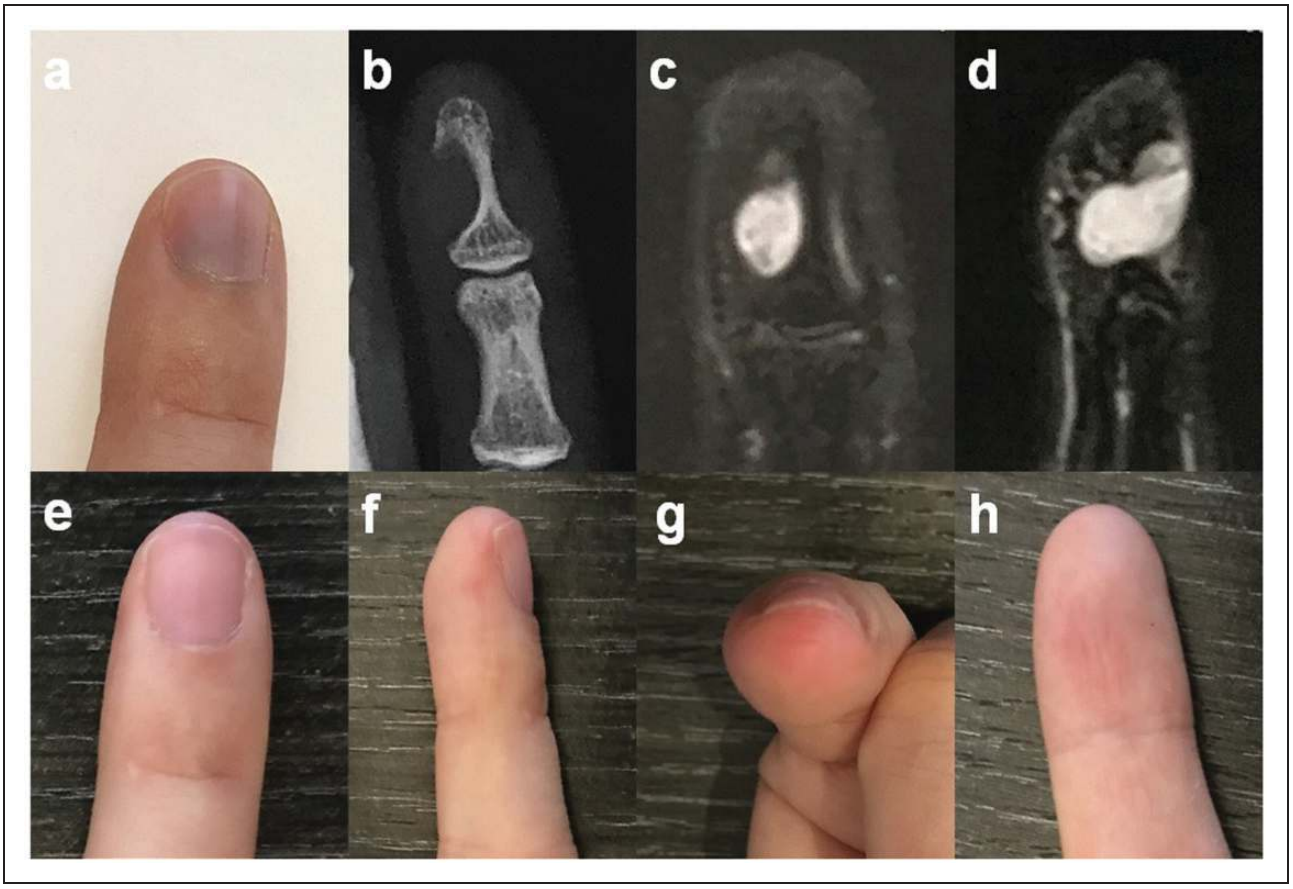

Figure 3. (a) Subungual bluish discoloration preoperatively and (b) radiograph showing radial side cortical thinning. (c) Coronal and (d) sagittal magnetic resonance images after gadolinium injection. Eight months postoperatively: (e) dorsal, (f) lateral, (g) fingertip and (h) pulp views.

Surgical approaches can be divided into two major groups: the nail unit sparing approaches (lateral paraungual, lateral subperiosteal and periungual), and the nail unit non-sparing approaches (transungual). Kim et al. (2018) conducted a multicentre study to analyse factors affecting surgical outcomes according to the techniques used. They concluded that the risk factors for recurrence were not predictable.

Although risk factors for recurrence are not well identified, a good surgical exposure is mandatory for complete resection. Meticulous repair of the nail bed at the end of surgery is essential (Van Geertruyden et al., 1996) along with nail plate restoration after avulsion. This is advocated by most authors who favour the transungual approach (Chou et al., 2016; Lee et al., 2009; Moon et al., 2004). The effects of transungual approaches on the appearance of the nail are not clear. Moon et al. (2004) noticed up to 19% of deformities that were actually distal nail splits, whereas longitudinal striations were not considered as nail deformities by others (Madhar et al., 2015). To perform a minimally invasive transungual approach, Ekin et al. (1997) created a window in the nail plate after lifting an eponychial flap. We think this approach provides limited access for curetting bone defects, perhaps resulting in recurrences and deformities from manipulation of the germinal matrix and eponychium. Roan et al. (2011) suggested a modified transungual technique, where an incision is made through the nail plate and nail bed together; the tumour pops up with no need for nail bed repair. Although this technique might be suitable for small tumours, we find it insufficient for curetting bone defects. Alternatives like the modified periungual (Fong et al., 2007) and nail bed margin approaches (Wang et al., 2013) have been suggested to avoid incision of the nail bed. We think they are surgically demanding and indicated only for proximal tumours. Wang et al. (2013) avulsed the plate and did not re-insert it. Our concern is that scarring might occur between the eponychium and matrix leading to nail deformities.

Lateral techniques are also a possibility to avoid nail bed and matrix violation. They are particularly suitable for peripheral lateral lesions (Vasisht et al., 2004). They are reputed to allow less exposure, possibly increasing the risk of recurrence, which may explain recurrences up to 16% in the survey of Vasisht et al. (2004).

Although glomus tumours are usually well encapsulated and easily enucleated, additional aids, such as the microscope (Huang et al., 2015; Lee et al., 2009; Muramatsu et al., 2014; Wang et al., 2013) or surgical loupes (Hufschmidt et al., 2017; Kim et al., 2018), optimize complete resection and help to distinguish pulp lesions from fat tissue.

We find that the subperiosteal approach creating a 'shark mouth' flap combines the advantages of both the transungual and lateral approaches. The former allows good exposure and the latter avoids injuring the nail bed and having to reconstruct it. Huang et al. (2015) advocate that subperiosteal approaches cannot expose centrally located tumours. After 7 years' experience with the 'shark mouth' technique, we have found all locations easily accessible because the large flap offers a wide surgical exposure, enabling complete tumour excision, while raising a composite flap of the nail bed and plate, thus exposing the matrices and phalanx perfectly. This is relevant in cases of multiple synchronous lesions where the whole nail bed must be explored. Lateral approaches allow early wound healing (Vasisht et al., 2004), whereas transungual incisions need 4 to 6 weeks to heal. We did not have infections or necrosis, because the dorsal flap containing the ungual complex is richly vascularized. Our approach is nail-sparing and the plate acted like a splint for the nail bed. There was one delayed recurrence in 24 patients, for which we had no explanation. This occurrence rate was no greater than with other techniques.

Madhar et al. (2015) use the 'shark mouth' approach, but only for peripheral tumours. Our technique is similar to that described by Garg et al. (2016). Their report and ours are the only ones to describe the procedure as the sole approach to all subungual locations. Like Garg et al. (2016) we find the approach simple; it respects the soft tissues and gives perfect exposure of the nail bed and phalanx. It is less time-consuming than other techniques. It may be used in its full version for tumours under the germinal or sterile matrix and as a partial version for tumours strictly lateral to the nail bed. The limitation of the 'shark mouth' flap is a superficial pulp tumour, where an anterior non-subperiosteal approach is more appropriate.

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