

## RESEARCH ARTICLE

# Selective Neck Dissection: A Novel Technique for Second Branchial Arch Anomalies

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## ABSTRACT

**Introduction:** To propose an operation similar to selective neck dissection (levels II, III and IV) as a method of successful management of second arch branchial anomalies.

**Materials and methods:** We did a prospective study on patients with branchial arch anomalies from the years 2009 to 2013. They underwent minimal radiological workup. All of them underwent a novel surgical procedure similar to selective neck dissection (levels II, III, IV) that lead to excision of the tract. Patients were followed up for an average period of 2 years.

**Results:** We had seven patients which included two branchial sinus, three cysts and two fistulae. All of them were operated and the tract was identified and completely excised by the above approach. None of them had any complications or recurrence on follow-up.

**Conclusion:** Branchial arch anomalies are rare congenital problems posing a significant challenge to an ENT surgeon. Inadequate and inappropriate surgeries resulting in recurrences are quite common. Attempts to get either a sinogram or fistulogram are often a failure and cumbersome.

Selective neck dissection from levels II to IV is a surgical maneuver which allows access to the involved anatomical segment of the neck. Thus, it is a structured and methodical approach that comprehensively leads to excision of the complete tract. It also reduces the chances of complications. Recurrences are rare with this technique.

**Keywords:** Second branchial arch anomalies, Selective neck dissection, Branchial cyst, Branchial fistula, Branchial sinus.

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## INTRODUCTION

Branchial arch anomalies are rare congenital conditions posing a significant diagnostic and therapeutic challenge to an ENT surgeon, who is usually the primary care physician for these patients. Inadequate and inappropriate surgeries

resulting in recurrences are quite common. Following recurrence, the subsequent management gets compounded further as frequently ordered imaging procedures add to the existing confusion rather than giving a clear picture. Attempts to get either a sinogram or fistulogram are often a failure and cumbersome. Once the clinical diagnosis is made, treatment should aim at successful management by excising the entire tract from the external opening till its origin, with least radiological workup.

We in our series adopted a novel technique similar to selective neck dissection (levels II, III, IV) to explore all these lesions, identify the tract and excise it in totality.

A persistent fistula of the second branchial cleft and pouch is expected to pass from an external opening in the mid or lower neck along the anterior border of the sternocleidomastoid muscle, deep to platysma along the carotid sheath, then passing deep between the internal and external carotid arteries and then crossing over the hypoglossal and glossopharyngeal nerves. It would then pass below the stylohyoid ligament to an internal opening in the intratonsillar cleft of the palatine tonsil.<sup>1</sup> A surgical maneuver which allows access to this anatomical segment of the neck should comprehensively lead to a thorough exploration, dissection and excision of the tract. Selective neck dissection (levels II, III, IV) is a standard surgical step during wide field laryngectomy and can be used judiciously to deal with this issue. Our target was not necessarily to clear all lymph nodes in levels II, III and IV but rather have a methodical approach for dissection and complete excision of the tract. Thus, we cleared only that fibrofatty tissue and lymph nodes that came in our way while we kept dissecting the tract from a safe distance. In this manner we avoided injuries to important structures in the vicinity.

## MATERIALS AND METHODS

The objectives of our study were to treat second branchial arch anomaly patients with minimal radiological workup by proposing an operation similar to selective neck dissection (levels II, III and IV) as a method of successful management of this anomaly. This prospective study was done at the department of ENT and Head and Neck Surgery of our institution during the period from 2009 to 2013. We had 7 patients with developmental anomalies of the second branchial arch: branchial cysts, sinuses and fistulae.

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Complete clinical examination was done. Contrast enhanced CT scan of Neck was done only in affordable patients. All patients underwent surgical excision by the method described below. All specimens were sent for histopathological examination. Regular follow-up was done. Average follow-up period was about 2 years.

### Surgical Method

All efforts were made to disinfect the track as much as possible prior to surgery. Betadine dressing, wash, gargles were employed. In one case of frank fistula, a nasogastric tube was inserted for feeding to decontaminate the track. All patients received antibiotics 2 days prior to surgery. Depending on the site of external opening either a mid-transverse or a 'J' shaped utility incision along the sternocleidomastoid muscle was taken. The external opening was always generously encircled with an ellipse and the incision developed. Subplatysmal flaps were raised and the entire anterior border of the sternocleidomastoid muscle was delineated superior and inferior to external opening (Fig. 1). The elliptical skin and the external opening was dissected away carefully medial to the sternocleidomastoid muscle border and the whole muscle was mobilized well-beyond the internal jugular vein. In the process, the superior belly of omohyoid muscle came into picture. The entire fibrofatty tissue along with some insignificant lymph nodes was dissected away superficial to internal jugular vein by following the descendens hypoglossi. In the process, as the dissection progressed cephalad, the fibrous or fibromuscular tract invariably came into the picture distinct from surrounding soft areolar tissue. The tract was then carefully followed well-beyond the hypoglossal nerve and digastric tendon. Once the tract passed through the superior constrictor muscle, depending upon its location in the oropharynx, the tract was ligated and excised enbloc (Figs 2 and 3).

### RESULTS

Out of the 7 patients in our study, 3 had branchial cysts while 2 patients had sinuses and 2 had fistulae. The male: female ratio was 4:3. Six of our patients were less than 30 years of age while 1 patient (branchial cyst) was 55 years old. Six patients had disease on left side while 4 had disease

on right side. Of the 3 patients with branchial cysts, 2 patients had been previously operated and presented with recurrence. One patient had an infected cyst. All the patients healed primarily with no complications. None of the patients had any neurologic sequelae. The average follow-up period was 2 years during which none of our patients had recurrence.

### DISCUSSION

Von Baer (1827) was the first to describe the branchial apparatus while its anomalies were first described by Von Ascheroni (1832).<sup>2</sup> Congenital anomalies of the branchial apparatus include branchial cyst (no external opening), branchial sinus (only external opening) and branchial fistula (with both internal and external openings).<sup>3</sup>

Ninety percent of branchial apparatus anomalies are from the second branchial arch and most common among them are branchial cysts (80.8%).<sup>4,5</sup> Second branchial cleft cysts are common in patients between 10 and 40 years of age, while fistulae and sinuses are found during the first decade of life.<sup>6,7</sup> There is no predilection for gender or any particular side of the neck (right or left).<sup>8,9</sup> In our study, there were 2 patients each in the first, second and third decades of life and one patient in the sixth decade who presented with a cyst.

Most of the patients with 2nd branchial arch anomaly present with a unilateral painless lump or fluctuant mass in the lateral portion of the neck along the anteromedial border of the sternocleidomastoid muscle either at the mandibular angle or in the lower neck. Rarely there may be a bilateral anomaly. Infected branchial cyst may be painful. Some patients may present with hoarseness or lower cranial nerve palsies (IX, X and XII) or a bulge in the overlying pharynx. Palsy of cranial nerves IX, X, XI, or XII is extremely rare in benign tumors or cysts. Patients with branchial sinus present with small congenital opening in the skin that drains mucus or fluid near the anterior border of the sternocleidomastoid muscle. In our series, 3 patients presented with a unilateral painless lateral neck swelling and 4 patients with a small opening in anterior aspect of the neck discharging mucus. One of them was infected.

Though the diagnosis is mostly clinical, various imaging modalities are often used to confirm the nature of the pathology, define anatomy and identify the fistulous tract

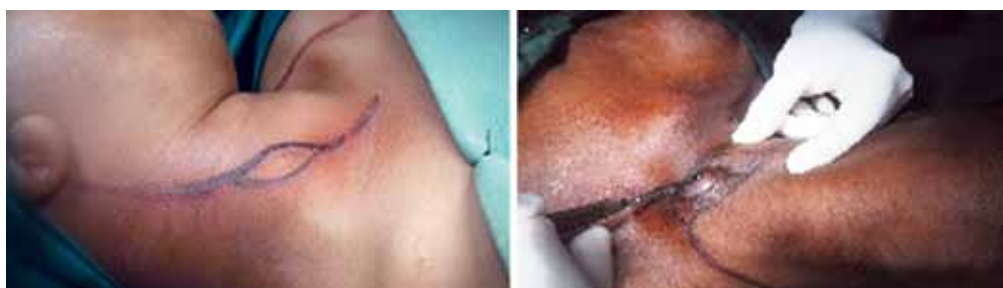
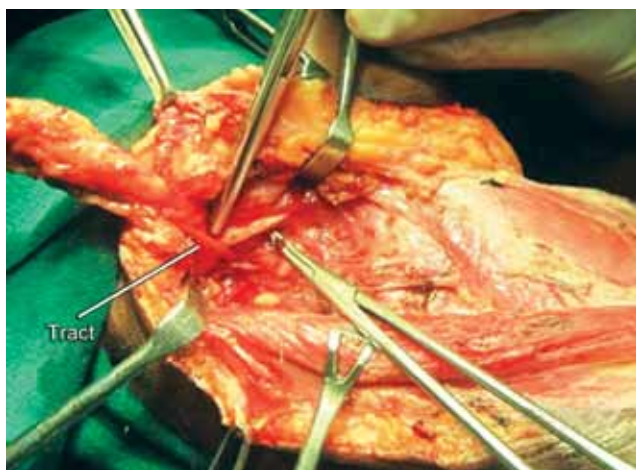
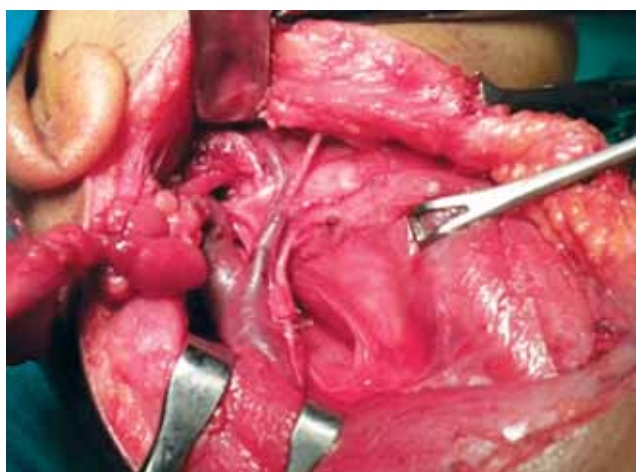


Fig. 1: Skin incisions for excision of branchial sinus (left half of figure) and branchial fistula (right half)



**Fig. 2:** The fistulous tract going deep to the digastric and styloglossus muscles toward the tonsil



**Fig. 3:** The sinus tract passing deep to the digastric muscle and superior to hypoglossal nerve

or sinus.<sup>10</sup> Imaging modalities include computed tomography (CT) scan, magnetic resonance imaging (MRI), fistulogram and ultrasonography (USG) of neck. Role of USG neck is limited as it fails to evaluate the extent and depth of lesions particularly the fistulae.<sup>11</sup> Preoperative fistulography may result in inflammation and scarring and incomplete delineation of the tract.<sup>12</sup> One study failed to find any advantage of using fistulography to aid excision, either pre- or intraoperatively.<sup>5</sup> CT scan can detect air density and with its superior resolution gives better delineation of fistulous tract.<sup>13</sup> However, the sensitivity of CT scan in defining the tract varies according to the machine and also the experience of the radiologist. Literature shows accuracy of a CT scan in diagnosing a sinus and fistula to be 81 and 50% respectively. Furthermore, infants and children often require sedation or even general anesthesia when undergoing this procedure.<sup>12</sup> MRI defines deep tissue extent which allows accurate preoperative planning.<sup>3</sup> A CT fistulogram with reformatted images or MRI are the best modalities available, but most studies prefer CT scan.<sup>13</sup> Few studies in literature have shown that preoperative imaging does

not affect complication or recurrence rates.<sup>12</sup> So imaging may not be mandatory in all cases of second branchial cleft anomalies.<sup>13</sup> In our study, CT fistulogram was done in only 2 patients. However, methylene blue was injected in 4 patients just before starting surgery. It could delineate the tract only in 2 patients completely (1 sinus and 1 fistula).

The treatment modalities in second branchial arch anomalies include sclerotherapy, stripping and surgical excision. Sclerosing agents are rarely used today due to the associated inflammatory reaction and the risk of necrosis with perforation into the pharynx and recurrence.<sup>4,14</sup> Stripping is not popular due to risk of damage to surrounding structures and risk of creating false passages.<sup>15</sup>

Complete surgical excision is the only definitive treatment.<sup>3,10,12,14</sup> Incomplete removal results in recurrent infections and distortion of surgical planes.<sup>12</sup> Cannulating the tract with monofilament suture or probe can also create false passage. The tract can also be injected with methylene blue; however, this may extravasate and stain the surrounding tissues making dissection difficult.<sup>16</sup> One study concludes that in practice, identification of the tract is not difficult as these tracts are invested in a layer of striated muscle which makes them quite substantial and fairly easy to follow.<sup>1</sup> Various incisions have been employed in surgical excision of branchial anomalies including hockey stick incision, step ladder incision, two separate transverse incisions and wide transverse cervicotomy incision.<sup>14,17</sup> The step ladder incision adopted by few authors' results in multiple incisions (2-3), difficulty in dissecting under the flap and risk of skin necrosis due to decreased vascularity. A hockey-stick incision or a transverse cervicotomy incision gives a single, more acceptable scar, better exposure of the tract and maintains skin vascularity thereby facilitating dissection and complete removal. In our series, all patients had a single incision along the neck crease which included the opening in a wide ellipse. A complete dissection of the fistulous tract was done by an operation similar to Selective neck dissection (levels II, III, IV). Only those lymph nodes and fibrofatty tissue which comes along the way is removed. The aim is not to remove all lymph nodes in the area but to have a methodical operation plan, thus minimizing chances of complications. This approach facilitates identification and dissection of all major blood vessels and nerves thereby preventing accidental injury to them and the entire anomalous tract can be removed enbloc under vision. Some studies have shown no recurrence while others have shown recurrence rates of upto 5%. All our patients had no recurrence till date (Table 1).

## CONCLUSION

Branchial arch anomalies are rare congenital problems. Clinical examination is sufficient to make the diagnosis.



**Table 1:** Comparison between different approaches for excision

Study	No. of patients	Imaging recommendation	Surgical approach	Recurrence
GR Ford et al (1992)	98	Little benefit	Transverse/step ladder	3%
FC Agaton-Bonilla (1996)	137	CT/MRI	Transverse incision	4.9%
JW Schroeder (2007)	51	No benefit	Transverse incision	5.1%
M Mitroi (2008)	23	CT/MRI	Transverse incision	Nil
Our study	7	No need	Selective neck dissection (levels II, III, IV)	Nil

Extensive preoperative imaging does not aid in precise delineation of the tract. Complete surgical excision is the only way to prevent recurrence. The physical location of the tract is easy to trace and is quite similar in all patients. Selective neck dissection (levels II, III, IV) gives access to the anatomical segment which actually contains the tract. Hence, it can be a definite surgical approach for a successful and structured exploration of second branchial arch anomalies. Recurrence and complications are rare by this method. Since, our case series of patients is very less, we recommend further multi-institutional studies for making this novel technique a standard procedure.

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