International Journal of Radiology Sciences

ISSN Print: 2664-9810
ISSN Online: 2664-9829
IJRC 2024; 6(2): 21-26
www.radiologyjournals.com
Received: 02-06-2024
Accepted: 05-07-2024

Dr. Rudresh Hiremath
MD, Department of Radiology, Narayana Medical College, Nellore, Andhra Pradesh, YSR University, and Health Sciences, Andhra Pradesh, India

Dr. Gurumurthy B
Assistant Professor, Department of Radiology, JIPMER, Jipmer Campus Road, Jipmer Campus, Puducherry, India

Dr. Vandana S
Assistant Professor, Department of Radiology, ESI hospital, Rajaji Nagar, Bengaluru, Karnataka, India

Dr. Divya Kini
Fellowship Resident, Department of Radiology, Kovai medical center and Hospital, Coimbatore, Tamil Nadu, India

Dr. Bala Abirami KB
Junior Resident, Department of Radiology, JSS Medical College, JSS Academy of Higher Education and Research, Mysore, Karnataka, India

Dr. Sai Siddarth Kosinepalli
Senior Resident, Fathima institute of medical sciences Kadapa Kadapa-Pulivendula Rd, Ramarajupalli, Kadapa, Andhra Pradesh, India

Corresponding Author:
Dr. Rudresh Hiremath
MD, Department of Radiology, Narayana Medical College, Nellore, Andhra Pradesh, YSR University, and Health Sciences, Andhra Pradesh, India

Stones to strictures - conventional sialography in current clinical practice

Dr. Rudresh Hiremath, Dr. Gurumurthy B, Dr. Vandana S, Dr. Divya Kini, Dr. Bala Abirami KB and Dr. Sai Siddarth Kosinepalli

DOI: https://doi.org/10.33545/26649810.2024.v6.i2a.25

Abstract
Introduction: In the current era of ever-evolving innovative technologies of MDCT and MRI, conventional sialography stands the ground as the imaging modality of choice for the diagnosis of salivary gland duct pathologies. High-resolution ductal anatomy and finer details are the pros of conventional sialography. Indications for conventional sialography are few and far, however, it is important in the current trend of slowly regressing the art of conventional procedures. The objective of the present study is to present a novel technique of performing conventional sialography and interpretation of its various pathologies.
Materials and Methods: 55 patients were enrolled in the study in which procedure was cancelled in 5 patients due to difficult cannulation. 19 subjects underwent parotid sialography and 31 submandibular sialography. Post-procedure images were read and the diagnosis was made & was correlated with clinical and surgical findings.
Results: 33 subjects were female and 22 were male. 19 subjects underwent parotid sialography and 31 submandibular sialography. Ten parotid and 12 submandibular sialograms were normal. Parotid sialectasis was found in 09 subjects and submandibular sialectasis in 10. Sialolithiasis was found in 09 submandibular glands. Stricture was found in one parotid sialograms.
Conclusion: Conventional sialography is a minimally invasive technique with high levels of accuracy in diagnosing ductal pathologies providing high-resolution images.

Keywords: Conventional sialography, sialolithiasis, sialodochitis

Introduction
Salivation is a mandatory physiological process of the human body with many functions. It is produced at the rate of 1 to 1.5 L per day in healthy individual [1]. Major and minor salivary glands are the factories producing such huge amounts of saliva referred to as whole saliva [2]. Major salivary glands are paired exocrine glands, named parotid, submandibular, and sublingual glands. The submandibular gland does the majority of salivation labor when the system is at rest, while the parotid and submandibular glands share equal responsibility when the system is stimulated [2]. Sublingual glands accounts for small proportions in both states.
Parotid glands are the largest salivary glands located in the parotid space having superficial and deep lobes wrapping the ramus of the mandible. Secretions of the gland are carried by the Stenson's duct which traverses superficial to the masseter muscle and pierces the buccinator before opening in the oral cavity opposite to the upper second molar tooth. Terminal branches of the facial nerve run through the parotid gland and divide the gland anatomically into superficial and deep lobes. The retromandibular vein and terminal part of the external carotid artery also run in the same plane and help to divide the gland imaging-wise into superficial and deep lobes [3, 4].
The submandibular gland is the second largest paired major salivary gland located in the submandibular space. Similar to the parotid gland, the submandibular gland has superficial and deep lobes with the transition at the free edge of the mylohyoid muscle where the gland wraps around the free edge of the muscle. The secretions of the submandibular gland are carried by Wharton's duct, which arises from the deep lobe of the gland and ascends antero-medially between mylohyoid, hyoglossus and genioglossus muscles.

The duct measures approximately 5cms in length and opens as 1-3 small openings at the caruncle at the base of lingual frenulum [3, 4].

Sublingual glands are the smallest paired major salivary glands situated beneath the mucus membrane of the floor of the mouth. There are 8 to 20 small ducts that open in the floor of the mouth and drain the sublingual glands. Small sublingual ducts which open separately into the oral cavity are called ducts of Rivinus [5, 6]. The duct of Bartholin is formed by the fusion of three or more sublingual ducts which joins the submandibular duct [5, 6].

Like other exocrine secretory organs, salivary glands are affected by many diseases like infections, duct calculi, duct strictures, inflammation and tumors.

Major salivary glands are easily imaged as they are the most superficial organs. High resolution ultrasonography, computed tomography, and magnetic resonance imaging have taken a big leap in diagnosing the diseases of salivary glands and their ducts[7]. However conventional sialography, an old orthodox technique of imaging parotid and submandibular gland ducts by retrograde instillation of positive contrast media, is still highly sensitive in diagnosing ductal pathologies with high-resolution images[8]. Sialography is not preferred for sublingual gland as it opens with multiple ducts in the oral cavity.

Materials and Methods

A prospective observational study was conducted in the Department of Radiodiagnosis JSS medical college & hospital, Mysuru, Karnataka on 55 patients who presented with clinical features of salivary gland pathologies like pain during eating, swelling of salivary glands & halitosis from the departments of surgery and otorhinolaryngology. The study period was about two years from August 2018 to September 2020. Out of 55 patients who enrolled in the study, 19 underwent parotid sialography and 31 submandibular sialography; five subjects were cancelled due to difficult cannulation.

a. Technique of Sialography

The basic principle of the procedure is dilating the ductal orifice cannulating the duct and instilling contrast media to opacify the ductal system. For visualization of ductal opening secretogouges like cut lemon or lemon extracts are used which makes glands pour out the secretions making it easier to identify the openings.

Basic instruments required for the procedure are cannula, 5 cc syringe, non-ionic contrast (5 ml), secretogogue like lemon or lemon extracts, sufficient light source / magnifying glasses and gauze sponge pads. Various cannulating instruments are used for conventional sialography, some are dedicated for sialography and others are modified. Soft plastic intravenous catheter, radiolucent thin walled Teflon tube, Rabinov feeding tube, angiocath are some of the modified cannulators[9]. Some of the companies have designed dedicated sialography kit with beveled cannula of 30 gauze with Luer-Lock connector and a 2.5 cc Luer syringe.

In our department we used modified butterfly cannula of 23 gauze. Needle of the 23 G butterfly cannula was loosened by scrapping the adhesive material at the base of the needle and was taken off completely from the plastic hub with the help of needle holder. Needle has sharp beveled edge on one side and blunt edge on the other side. Now needle is replaced into the hub but with sharp end entering the tube and blunt end outside. This modified butterfly needle serves two purposes, blunt end of the needle is non traumatic to mucosa & ductal opening and stiff enough to manipulate and second one is longer tube helps to inject the contrast much away from primary beam of x rays. Before cannulating the duct with this needle make sure you fill the tube with contrast to prevent inadvertent injection of air within the ductal system. Prior to cannulation frontal and oblique projection radiographs are taken to look for the radio-opaque calculi.

b. Technique of Parotid gland sialography

Stensen's duct opens opposite to the second upper molar tooth. The ductal opening is made obvious by using lemon extract and milking the gland. Duct is identified as saliva started spurting / flowing through the duct. Overlying mucosa should be cleaned with gauze and abducted slightly with index finger and thumb for better exposure of the duct opening. Duct is cannulated with modified butterfly needle. Inject 1 to 2 cc of non-ionic water soluble contrast under the fluoroscopic guidance. As the ductal system dilates patient may complain of mild discomfort. Take two table top radiographic exposures in antero-posterior and oblique projections.

c. Technique of Submandibular gland sialography

Wharton's duct opens in the floor of the mouth near the sublingual papilla. Opening is much smaller than the Stensen's duct. Opening is difficult to visualize. Using the same technique of lemon extract and milking of gland, ductal opening is made obvious. Gauze is used to dry the area; tongue is pushed upward and backwards to put some tension over the papilla. Duct should be cannulated with modified butterfly needle and advanced slowly to avoid damage to the duct and floor of the mouth. Once duct was cannulated, 0.5 to 1 cc of contrast was instilled slowly under fluoroscopic guidance. Patients complained of mild pain while instilling contrast. Radiographs were obtained in oblique and frontal projections.

Sialography is divided into three phases, filling phase, parenchymal opacification phase and post evacuation phase. As their name suggests ductal branches are gradually filled up in the filling phase and in parenchymal phase acinar cells are filled which helps to pick up small masses. Post evacuation phase radiography is done after 5 minutes of parenchymal phase to see the contrast clearance from the duct. The phase can be exaggerated by the use of lemon extract. Incomplete evacuation suggests functional obstruction.

Results

60% (33) of subjects were female and 40% (22) were male among 55 patients. Out of 55 cases that underwent sialography procedure five (one male & four female) were cancelled due to difficult cannulation. 19 subjects (8 male & 11 female) with clinical features of parotid pathologies underwent parotid sialography with cannulation of 38 ducts, whereas those remaining 31 (13 male & 18 female) subjects with clinical features of submandibular gland pathologies underwent submandibular sialography with cannulation of 62 ducts. Ten parotid sialograms and 12 submandibular sialograms turned out to be normal. Parotid sialectasis was found in 9 subjects; out of 18 cannulated ducts 12 parotid

glands depicted sialectasis (six subjects had unilateral and three had bilateral disease). One female subject with bilateral parotid sialectasis had features of Sjogren's syndrome.

Submandibular sialectasis was found in 10 subjects; out of 20 cannulated ducts 14 submandibular glands depicted sialectasis (eight subjects had unilateral and three had bilateral disease). Sialolithiasis with or without sialectasis was found in 08 submandibular sialograms and all were unilateral. One patient of parotid sialogram showed features of multiple duct strictures. All patients were followed up and diagnosis was affirmed with clinical and surgical ways. Subjects with sialolithiasis underwent surgery for extraction of calculi and those with sialectasis treated medically.

Discussion

Salivary glands which are the major source of salivation are not devoid of diseases and are prone to various pathologies like inflammatory, infections, ductal calculi & neoplasms. Due to their superficial location in the body, high resolution ultrasonography is primary modality to screen and diagnose majority of the diseases. However imaging of ductal pathologies requires high resolution details, and is conveyed by the conventional sialography.

Stensen's duct drains parotid glands and opens opposite to the second upper molar tooth. It is approximately 6-7 cms long and 1-2 mm in caliber. Small anterior C shaped curve is seen as it bends around buccal fat pad and pierces buccinator muscle. Main duct divides into upper and lower hilar ducts and shows arborisation into the terminal glandular branches appearing as leafless tree pattern [Figure no. 1]. Ducts do not lie parallel. On the frontal projection ducts lie within 15-18 mm of lateral cortex of ramus of mandible. If there is more lateral displacement of the duct then suspect masseteric mass or hypertrophy [10].

Wharton's duct is approximately 5 cms long and 1-2 mm in caliber and run downwards and laterally at about 45 degrees to both horizontal and sagittal planes [10]. Before entering into the gland the duct shows mild caudal curve along the free edge of mylohyoid. Intraglandular ducts are shorter and taper more abruptly than those in the parotid gland [Figure no. 2].

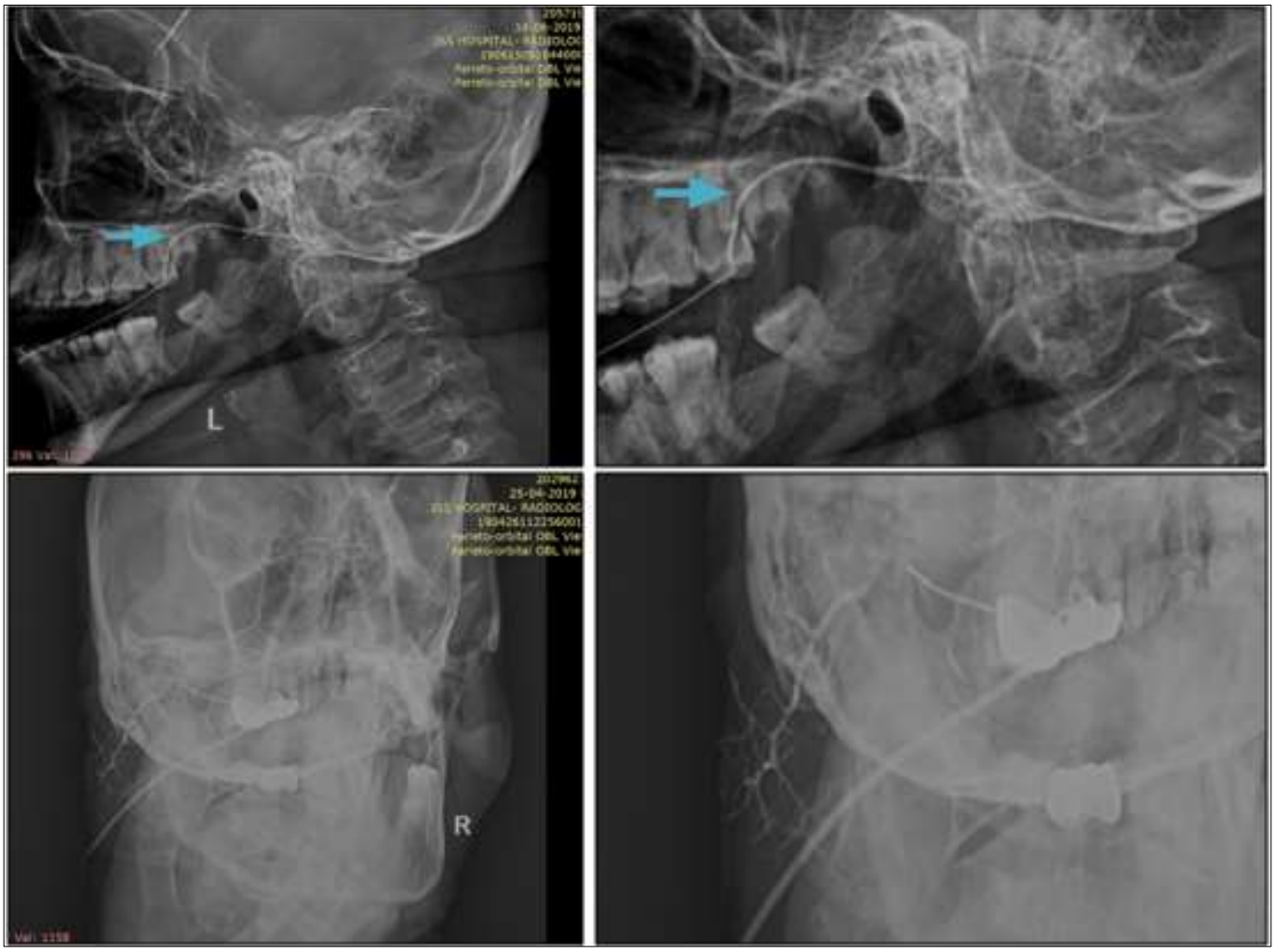

Fig 1: Conventional parotid sialography depicting normal Stensen's duct with terminal glandular branches as leafless tree pattern. Terminal glandular ducts do not lie parallel

Fig 2: Conventional submandibular sialography depicting normal Wharton's duct. Intra glandular ducts are shorter and taper abruptly

Sialothiasis is the most common disorder of the salivary glands and are sequelae to infection or stasis. 80 to 90% of salivary duct calculi occur in submandibular glands, 10 to 20% in parotid and 1 to 6% in the sublingual glands [11]. 25% sialolithiasis are multiple and bilateral ductal calculi are seen in only 2.2%. 80% of submandibular and 60% of parotid ductal calculi are radiopaque [13]. In the present study, 08 subjects had submandibular sialolithiasis and all were unilateral and radio-opaque. In Wharton's duct 30% of calculi are found near the ostium, 20% in the mid portion, 35% at the bend in duct where it curls around myolohyoid muscle [14]. Ductal calculi can cause complete obstruction with eventual glandular atrophy or cause partial obstruction with ball valve effect and produce recurrent infection. In our study three calculi were found at the ostium, 3 at the mid duct and remaining two at the bend [Figure no3 & 4].

Fig 3: Conventional left submandibular sialography of 45 year old female with history of left submandibular swelling shows Dilatation of both central and peripheral ducts with well-defined oval filling defect in the mid portion of the duct suggestive of sialolithiasis.

Various hypothesis is put forward to solve the mystery of high incidence of sialothiasis in submandibular glands. Thick mucus nature of submandibular secretions, more alkaline PH, higher concentration of hydroxyapatite and phosphatase, narrower orifice of Wharton's duct and antigravity secretions from caudally placed glands are few of them [14].

Fig 4: Skull radiograph Antero-posterior projection and Conventional right submandibular sialography of 48 year old female with history of right submandibular swelling for last six months shows well defined rounded radio-opacity in the submandibular region. On contrast administration there is moderate dilatation of central and peripheral ducts due to calculus at the orifice

Sialectasis is abnormal dilatation of the salivary gland ducts developed secondary to chronic sialadenitis and sialodochitis [Figure no.5]. The causes could be infection, chronic inflammation like Sjogren's or ductal calculi[10]. Other conditions like RA, SLE, Ankylosing spondylitis, Reiter's and PAN can produce similar findings. In current study nine subjects had parotid sialectasis and 10 had submandibular sialectasis. One female patient aged 45 years had bilateral parotid sialectasis secondary to Sjogren's syndrome. Rest of the patients were thoroughly investigated, connective tissue and inflammatory disorders were ruled out.

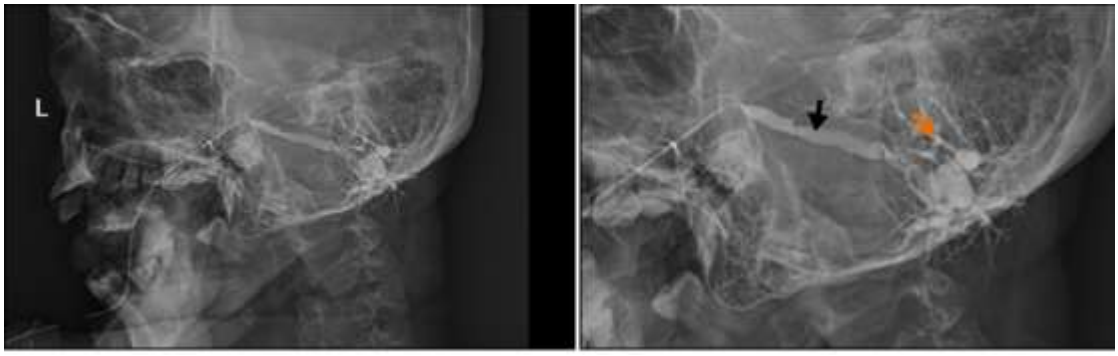

Fig 5: Conventional left parotid sialography of 40 year old female with history of bilateral painful parotid swelling for last 3 months depicts Dilatation of both central and peripheral ducts with intermittent strictures consistent with sialectasis secondary to chronic sialadenitis & sialodochitis

Strictures are second most common cause of sialadenitis after sialolithiasis and are more common in parotid gland ducts [10]. Causes are infection, calculi, trauma, cheek biting, ill fitted dentures & extrinsic compression. Trauma and ill fitted dentures causes strictures at duct orifice. Conventional sialography depicts these strictures as short segmental narrowing with upstream dilatation of the ducts. If strictures are complete then the gland undergoes atrophic changes, whereas incomplete strictures results in recurrent Sialadenitis and/or glandular mucocele. In the present study we had one case of multiple short segment strictures of Stenson's duct with upstream dilatation proximal ducts secondary to recurrent infections [Figure no. 6].

Fig 6: Conventional right parotid sialography of 54 year old male with history of right parotid swelling and pain shows multiple strictures and dilatations involving the central duct

Among various autoimmune diseases Sjogrens syndrome most commonly affects the salivary glands. Sjogrens syndrome is autoimmune disorder due to lymphocyte mediated destruction of exocrine glands, predominantly affecting the salivary and lacrimal glands[16]. Clinically these patients presents with dryness of mouth, oral ulcers, difficulty in swallowing, grittiness in the eyes and inability to cry.

During early stages of the disease central ductal system is normal whereas intra glandular ducts and acini are destroyed resulting in multiple, tiny punctate collections filled with contrast material in sialography distributed uniformly throughout the gland. As the disease progresses the punctate collections increases in size. On sialography this gives appearance of 'fruit laden leafless tree' pattern or 'mulberry tree' pattern [Figure no. 7]. Further progression of the disease results in complete destruction of acini and decreased salivary secretion resulting in superimposed recurrent infections [10]. On sialography Sjogrens syndrome reveals features of Sialadenitis and sialodochitis in the form of duct dilatations and wall irregularity. Current study revealed one case of Sjogrens syndrome affecting bilateral parotid glands in 45 year old female.

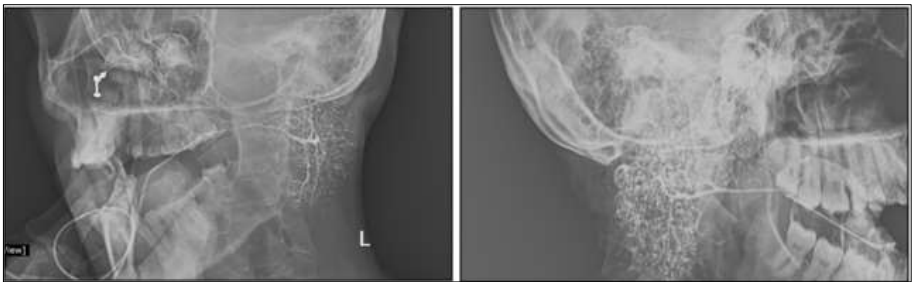

Fig 7: Conventional bilateral parotid sialography of 45 year old female with history of bilateral painless parotid swelling. Multiple punctate collections of the contrast material uniformly distributed throughout both the glands - S/o Sjogren Syndrome. "Fruit laden leafless tree pattern"

Other pathologies of salivary glands can be depicted on sialograms like Kussmaul's disease and salivary gland neoplasm. Kussmauls disease is also known as sialodochitis fibrinosa is an entity seen in dehydrated and debilitated patients characterized by recurrent painless or painful attacks of major salivary gland swelling secondary to mucus plug blocking the salivary ducts [15]. On sialography mucus plug is seen as filling defect which is radiolucent on plain films. Treatment is use of secretogogue to release the plug with glandular massage. Salivary gland neoplasm on conventional sialography reveals duct displacement and duct infiltration in the form of fragmentation or abrupt cut off salivary ducts [17].

In this study conventional sialography aided in the diagnosis of sialolithiasis, sialectasis and autoimmune disorders like Sjogrens syndrome with high resolution imaging and pin point findings. Approximately 9% of cases were cancelled due to difficult cannulation. None of the subjects developed intra or post procedure complications. Average time taken to perform the procedure was 20-30 minutes. Some of the major cons of the study are, it is minimally invasive, tiring for patients to open the mouth for minutes until the duct is cannulated, direct radiation exposure to the performing radiologists and the patients.

Conclusion

Various studies are conducted comparing the conventional sialography with MR Sialography. Even though MR Sialography is non-invasive with no contrast required and shows comparable results with conventional sialography it is plagued by few limitations. Secondary and tertiary branches are poorly assessed & it is difficult to distinguish between complete and partial obstruction. Likewise conventional sialography has many limitations, it is contraindicated in the acute infections, invasive, radiation exposure to patient and the radiologist and procedure related complications like injury to oral mucosa.

With appropriate technique and skills conventional sialography illustrates salivary ductal pathologies with fine accuracy. It still continues to be gold standard technique for imaging the ductal system. In case of failure of the procedure MR sialography acts as alternative.

References

1. Humphrey SP, Williamson RT. A review of saliva: normal composition, flow and function. J Prosthet Dent. 2001;85(2):162-169.
2. Iorgulescu G. Saliva between normal and pathological: important factors in determining systemic and oral health. J Med Life. 2009;2(3):303-307.
3. Batasakis J. Tumor of head and neck: clinical and pathological considerations. 2nd ed. Baltimore: Williams and Wilkins; c1979. p. 1-120.
4. Peel R, Gnepp D. Diseases of salivary glands. In: Gnepp LB, editor. Surgical pathology of head and neck. New York: Marcel Dekker; c1985. p. 533-545.
5. Mason D, Chisholm D. Salivary glands in health and disease. London: WB Saunders Co; c1975. p. 3-18.
6. Gray H. Anatomy of the human body. In: Goss C, editor. Philadelphia: Lea and Febiger; c1959. p. 1237-41.
7. Rastogi R, Bhargava S, Mallarajapatna GJ, Singh SK. Pictorial essay: Salivary gland imaging. Indian J Radiol Imaging. 2012;22(3):325-33.
8. Kalonowski M, Heverhagen JT, Rehberg E, Klose KJ, Wagner HJ. Comparative study of MR sialography and digital subtraction sialography for benign salivary gland disorders. AJNR Am J Neuroradiol. 2002;23:1485-1492.
9. Varghese JC, Thornton F, Lucey BC, Walsh M, Farrell MA, Lee MJ. A prospective comparative study of MR sialography and conventional sialography of salivary duct disease. AJR Am J Roentgenol. 1999;173(6):1497-14503.
10. Som PM, Curtin HD. Head and neck imaging. 5th ed. St. Louis: Mosby; c2011. p. 2462-622.
11. Rabinov K, Weber A. Radiology of salivary glands. Boston: G. Hall; c1985. p. 1-121.
12. Adeyemo WL, Ajayi OF, Anunobi CC, Ogunlewe MO, Ladeinde AL, Omotola OG, *et al*. Submandibular gland excision: A 16-year clinicopathological review of cases in a Nigerian teaching hospital. Oral Surg. 2008;1:45-49.
13. Krishnamurthy S, Lanier A, Dohan P, Lanier JF, Henle W. Salivary gland cancer in Alaskan natives. Hum Pathol. 1987;18:986-986.
14. Leung AK, Choi MC, Wagner GA. Multiple sialoliths and a sialolith of unusual size in the submandibular duct: A case report. Oral Surg. Oral Med Oral Pathol Oral Radiol Endod. 1999;87:331-333.
15. Ray A, Burgin SJ, Spector ME. A rare case of Kussmaul disease (Sialodochitis fibrinosa). J Case Rep Med. 2015;4(1+3):235894.
16. Egashira R, Kondo T, Hirai T, Kamochi N, Yakushiji M, Yamasaki F, Irie H. CT findings of thoracic manifestations of primary Sjögren syndrome: radiologic-pathologic correlation. Radiographics. 2013;33(7):1933-1949.
17. Hansson LG, Johansen CC. CT sialography and conventional sialography in the investigation of parotid masses. Oral Surg. Oral Med Oral Pathol. 1987;64(4):494-500.