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Review Article

Sialography- A Diagnostic Tool in Salivary Gland Disorders: A Review

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ABSTRACT

Sialography is a vital imaging technique utilized to visualize the salivary glands and ducts, aiding in the diagnosis of various salivary gland pathologies, including sialolithiasis, sialadenitis, and neoplasms. This procedure involves retrograde injection of a contrast medium, followed by radiographic imaging, enabling detailed assessment of ductal anatomy and pathology. While sialography has some limitations, such as discomfort during the procedure and potential adverse reactions to contrast agents, it remains an essential diagnostic tool. Its unique advantages include functional assessment, cost-effectiveness, and real-time visualization, which are particularly beneficial in guiding surgical interventions and monitoring post-treatment outcomes. Sialography complements other imaging modalities like ultrasound, CT, and MRI, ensuring comprehensive evaluation and optimized patient care in managing salivary gland disorders.In this paper we will be benefited with the knowledge of basic principles and wide array of application in salivary gland pathology,also deals about merits and demerits of sialography.

INTRODUCTION

Sialography, an imaging technique used to visualize the salivary glands and ducts, plays a crucial role in diagnosing various salivary gland pathologies. It involves the retrograde injection of a contrast medium into the duct system, followed by radiographic imaging. Despite the advent of advanced imaging modalities like MRI and CT, sialography remains valuable in specific clinical scenarios due to its unique ability to demonstrate ductal anatomy and pathology.[1] Sialography is a diagnostic imaging technique primarily used to visualize the salivary glands and their ducts. It is particularly indicated for various conditions, including obstructive disorders like sialolithiasis, strictures, and mucous plugs. Additionally, sialography helps evaluate inflammatory diseases such as sialadenitis and Sjögren's syndrome by assessing ductal changes and glandular function.[2] Furthermore, it aids in the diagnosis of neoplastic

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lesions, both benign and malignant, by highlighting alterations in the ductal system and glandular architecture. Congenital abnormalities affecting the salivary ducts can also be assessed using sialography, allowing for a better understanding of their impact on salivary function. Sialography plays a crucial role in diagnosing salivary gland pathologies, particularly in identifying conditions such as sialolithiasis, ductal obstructions, and inflammatory processes. This imaging technique enhances visualization of the salivary ducts, allowing for accurate diagnosis and subsequent treatment planning. It is also effective in detecting mucus plugs that can obstruct the ducts, particularly in patients with Sjögren's syndrome[3]. For inflammatory salivary gland diseases, sialography assesses the extent of inflammation and ductal damage in conditions like acute and chronic sialadenitis, while also evaluating ductal dilation and strictures associated with Sjögren's syndrome. In the context of neoplastic salivary gland diseases, sialography aids in differentiating between benign tumors, such as pleomorphic adenomas and Warthin's tumors, especially when they involve the ductal system. Although not the primary diagnostic tool for malignant tumors, sialography can provide additional information about the extent of ductal involvement and potential obstruction. Additionally, sialography is useful for identifying congenital salivary gland anomalies, including ductal strictures, diverticula, and cysts.[4] This article gives an overview on the role of sialography in diagnosis of salivary gland pathology.

Principles Of Sialography

Conventional sialography involves a systematic technique to visualize salivary duct anatomy and pathology. Initially, control images are taken with the patient in a supine position to assess for radiopaque calculi, using lateral oblique and lateral views. For submandibular sialography, tongue depressors are employed to aid in visualization. Patients may be instructed to suck on a lemon or a secretory stimulant for 2-3 minutes prior to the procedure to make the salivary duct opening more conspicuous for cannulation. The symptomatic parotid or submandibular duct is then cannulated, typically with a 21-gauge catheter for Stensen's duct, located adjacent to the crown of the second upper molar in the buccal mucosa; gentle abduction of the cheek with the thumb and index finger can facilitate this process. For Wharton's duct, a 24 or 27-gauge catheter is used, and the orifice is found at the base of the frenulum of the tongue; raising the tip of the tongue until it touches the hard palate can help tense the submandibular duct papilla, making cannulation easier. If the orifice is not visible, citric acid may be applied to promote secretion from the submandibular gland, followed by the use of a silver probe to dilate the orifice for catheter introduction. Typically, up to 2 mL of water-soluble contrast is instilled, with care taken to avoid introducing air into the salivary ducts, as this can mimic a ductal calculus on sialography. Following the procedure, lemon or a secretory stimulant can be utilized to purge the contrast, and post-procedure images may be obtained to assess for residual contrast.[7] The advantages of conventional sialography include higher spatial resolution for superior diagnostic elucidation, particularly in accurately delineating second- and third-order branches, and the ability to enable therapeutic approaches in sialendoscopy for the removal of sialoliths, retrograde displacement of sialoliths to relieve acute obstruction, and dilation of strictures. However, this invasive procedure has notable disadvantages, including a substantial failure rate—especially in submandibular sialography—due to cannulation issues, lack of skill, patient non-compliance, and pain. Additional concerns include radiation exposure, potential allergic reactions to contrast media, and complications such as local pain, perforation of the submandibular duct, and the risk

of infection, which should be suspected if pain persists for more than 24 hours, necessitating consideration for antibiotic treatment.[8]

Contrast Agents In Sialography

The salivary glands, being soft-tissue structures, cannot be visualized radiographically. They are visualized by the technique of sialography which involves the technique of retrograde filling of the luminal system of the gland with radiopaque contrast media. August Fredrick used mercury as a contrast agent and Carpy performed the first sialography on an isolated parotid gland.

Contrast sialography can be performed using either lipid-soluble or water-soluble agents. A major advantage of the lipid-soluble agents is that they are not diluted saliva or absorbed across the glandular mucosa, resulting in optimum opacification of both ductal and acinar elements. This is especially important when sialography is done to see small peripheral masses.Water-soluble angiographic dyes containing about 28–38% iodine have also been used in contrast sialography. A major problem associated with the use of these dyes is that they are diluted by saliva and get rapidly absorbed across the glandular elements, often resulting in overall poor radiographic density and suboptimal demonstration of the peripheral ducts and acinar opacification. [22]

Classification Of Contrast Agents Used In Sialography

Lipid Or Fat Soluble Contrast Media

Iodised oils are preferred in arthrography because they include ethiodol, lipoidal. They have an iodine content ranging from 37% and they have the advantage of being dissipated to 41% (w/w). They have a specific gravity ranging from 1.28 to 1.36 at 15°C. They are highly viscous, with their viscosity ranging from 80 to 100 cP. They produce sustained opacity, making it possible to study the post evacuation phase. They produce sharper visualization with good resolution of the most peripheral ducts. Also they produce a greater degree of discomfort to the patient. They tend to retain within the glands when over- filled and cause an inflammatory reaction resulting in granuloma formation and subsequent fibrosis. It causes clouding of the gland due to greater amounts of contrast medium within the lining of fine ducts and capillaries.[22]

Water-Insoluble Organic Iodine Compounds

Pantopaque, Myodil, Hypaque 50, Urografin, Hypaque73, Renografin 60 and 73, Renografin 60 and 75, Amipaque, Isopaque, Conray 80, Conray 420 and Omnipaque are various water-soluble organic iodine-based contrast media. They are miscible with the body fluids and saliva.They have an iodine content ranging from 28 to 30 (w/w) and viscosity ranging from 2 to 10 cP. These media are all hypertonic in comparison to plasma and saliva. Water-soluble contrast media have the advantage of filling the finer duct system due to their physical properties. They cause less pain and discomfort to the patient. They are rapidly removed from the tissues. They do have few disadvantages, such as they have less degree of radiographic density and contrast. They require the radiographs to be taken as soon as possible after introduction of the medium.[22]

Types

There are three main types of sialography: conventional or fluoroscopic sialography, which may or may not use digital subtraction techniques; CT sialography, known for its ultrafast imaging capabilities; and MR sialography, which employs heavily T2-weighted sequences to visualize the salivary ducts, potentially eliminating the need for canalization. While sialography is a valuable diagnostic tool, ultrasound is often an appropriate initial imaging modality for investigating ductal pathology, particularly in cases of sialolithiasis, as it is a readily available, noninvasive, and cost-effective option. Ultrasound is especially useful for visualizing the parotid glands, where ducts can

be better assessed if they are dilated due to obstruction.[5,6]

Applications Indications

1. To evaluate
- Ductal obstruction due to stones
- Ductal dilation
- Ductal strictures
- Ductal rupture

2.To determine presence and position of calculi

3.to asses the extent of ductal and glandular destruction secondary to an obstruction

4.To determine the location size and origin of a swelling or mass

5.detection of fistulae ,diverticula and strictures.[21]

Contraindications

- Allergy to compounds containing iodine
- Periods of acute infection or inflammation
- Calculus close to the duct [22]

Merits

Sialography plays a crucial role in pre-surgical assessments, guiding interventions for various salivary gland conditions, such as sialocutaneous fistulas and sialadenitis. Its ability to visualize ductal anatomy and pathology assists surgeons in planning effective surgical strategies, ultimately improving patient outcomes. Furthermore, sialography is valuable for monitoring post-treatment outcomes, with patient follow-ups frequently demonstrating symptom resolution and confirming the effectiveness of interventions. The advantages of sialography are multifaceted; it provides a comprehensive functional assessment by delivering information on both the structural and functional aspects of the salivary glands, which is essential for diagnosing and managing disorders. Additionally, it is a cost-effective option, being less expensive than MRI or CT imaging, while still offering critical diagnostic information. Sialography also allows for real-time visualization, enabling dynamic assessments of ductal patency and flow characteristics, which can be instrumental in understanding the functional status of the salivary glands. This combination of benefits underscores the ongoing relevance of sialography in contemporary diagnostic practice, particularly in the management of salivary gland diseases.[19,2]

Demerits

- Radiation exposure: Sialography exposes patients to radiation, which can be especially harmful to pregnant or breastfeeding people.
- Invasive procedure: Sialography involves inserting a tube into the salivary ducts, which can be uncomfortable and cause pain or swelling.
- Contrast dye allergy: Patients should get an allergy test before the procedure, and tell their doctor if they already know they have an allergy.
- Contraindicated in certain conditions: Sialography is not recommended for patients with acute infections, thyroid disease, or iodine allergies.
- Quality dependent on technician: The quality of the study can depend on the technician performing it.
- Can dislodge calculi: Sialography can dislodge calculi, which can lead to inflammation or bleeding.
- Can cause ductal perforation: Sialography can cause ductal perforation. [21]

Phases In Sialography

The procedure is divided into three phases:

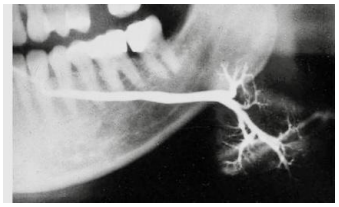
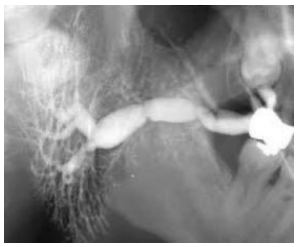
- Pre Operative Phase
- This involves taking pre operative radiographs before the introduction of the contrast medium.
- Filling Phase :
- This phase involves ductal dilation \ probing and cannulation of ductal orifices
- The dye is slowly introduced into the duct.
- The amount to be injected varies from patient to patient.
- the patient is instructed to inform gland fullness.
- It includes two phases
- ductal phase- Filling of ducts

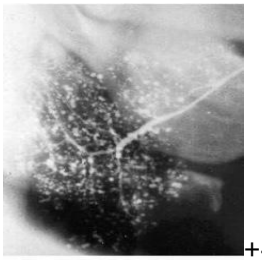
- Acinar phase - Filling of acini
- Approximate amount of contrast medium
- parotid- 0.7 - 1 ml
- Submandibular gland - 0.5 - 0.7 ml
- Radiograph should be taken with panoramic radiograph, occlusal , puffed cheek,etc.
- Emptying Phase
- The use of lemon juice at this stage to aid excretion of the contrast medium
- after 1.5 minutes the emptying phase radiographs are taken
- These films can be used as assessment of function. [21]

Comparison With Other Techniques

Although traditional imaging methods are gradually being replaced, sialography continues to serve as a complementary technique alongside ultrasound (USG), computed tomography (CT), and magnetic resonance (MR) imaging, particularly for the visualization of smaller salivary stones.[16] Ultrasound is non-invasive and ideal for detecting salivary stones. CT scans offer high-resolution images for identifying stones, tumors, and inflammatory changes. MRI provides excellent soft tissue contrast, differentiating between benign and malignant tumors. Sialendoscopy allows direct visualization of the ductal system for therapeutic interventions Sialography is especially effective in detecting obstructions and delineating ductal anatomy, providing detailed insights that can be crucial for diagnosis and treatment planning. Recent studies suggest that MR sialography may surpass three-dimensional cone beam computed tomography (3D-CBCT) in identifying sialolithiasis and ductal dilatations, demonstrating its enhanced sensitivity and specificity. This comparative advantage emphasizes the ongoing relevance of sialography in the diagnostic workflow for salivary gland pathologies, ensuring that clinicians have access to a comprehensive array of imaging modalities to optimize patient care.[17,18]

Sialographic Appearances Of Salivary Gland :

Normal Parotid Gland	 **Tree In Winter Appearance**
Normal Submandibular Gland	 **Bush In Winter Appearance**
Sialodochitis	 **Sausage Link Appearance**

Sjogren's Syndrome	 +- **Cherry Blossom Appearance**
Intrinsic Tumor	 **Ball In Hand Appearance**
Proximal Dilation Of Salivary Duct	 **Salivary Stones**

CONCLUSION

In conclusion, while sialography offers numerous advantages as a diagnostic tool for salivary gland pathologies, it is not without its limitations. Some patients may experience discomfort during the procedure, which can impact their overall experience. Additionally, the use of contrast agents poses certain risks, as these substances may not be suitable for everyone, particularly those with allergies to iodinated materials or certain medical conditions. Despite these challenges, sialography remains an essential component of the diagnostic toolkit for evaluating salivary gland disorders. Its ability to provide detailed insights into ductal anatomy, functionality, and pathologies continues to make it invaluable for clinicians. By accurately identifying conditions such as sialolithiasis, sialadenitis, and other abnormalities, sialography plays a pivotal role in guiding treatment decisions and improving patient care. As such, it is crucial to weigh the benefits against the potential limitations when considering sialography for diagnosing salivary gland conditions, ensuring that it is utilized effectively to enhance patient outcomes

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