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Review article

Sialendoscopy in juvenile recurrent parotitis: a review of the literature

La scialoendoscopia nella parotite ricorrente giovanile: una revisione della letteratura

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SUMMARY

Juvenile recurrent parotitis (JRP) is the second most frequent salivary gland disease in childhood, defined as a recurrent non-suppurative and non-obstructive parotid inflammation. The recurring attacks actually represent the most dramatic and serious aspect of this pathology, since they significantly influence the quality of life, and there are no recognized therapies to avoid them. In recent years, there are reports of many international experiences related to the management of JRP by sialendoscopy. In this context, several authors have stressed the striking role of sialendoscopy in the prevention of JRP attacks. The objective of the current review is to overview the existing literature with particular regards to diagnostic and therapeutic outcomes after the application of sialendoscopy in patients suffering from JRP.

KEY WORDS: Sialendoscopy • Sialoendoscopy • Juvenile recurrent parotitis • Recurrent acute parotitis • Paediatric • Endoscopy

RIASSUNTO

Processo flogistico ricorrente non suppurativo e non ostruttivo della parotide, la parotite ricorrente giovanile (PRG) rappresenta la seconda patologia più frequente delle ghiandole salivari nell'infanzia. Gli attacchi ricorrenti ne costituiscono l'aspetto più serio e drammatico: incidono significativamente sulla qualità di vita e non esistono terapie preventive validate. Negli ultimi anni, la letteratura ha testimoniato la nascita di numerose esperienze internazionali correlate alla gestione della PRG con la scialoendoscopia. In questo contesto, molti autori hanno enfatizzato il ruolo cruciale della scialoendoscopia nella prevenzione degli attacchi di PRG. L'attuale revisione si propone l'obiettivo di valutare la letteratura esistente, con particolare riferimento agli aspetti diagnostici e terapeutici della scialoendoscopia applicata in pazienti affetti da PRG.

PAROLE CHIAVE: *Scialendoscopia • Scialoendoscopia • Parotite ricorrente giovanile • Parotite acuta ricorrente • Pediatrico • Endoscopia*

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Introduction

In childhood, parotid swelling is usually due to inflammation or microbial involvement of the parotid gland, although differential diagnosis includes mumps, Godwin's benign lymphoepithelial lesion, HIV, Mikulicz disease and Sjögren's syndrome [1 2]. After paramyxovirus infection (mumps), juvenile recurrent parotitis (JRP) is the second most frequent salivary gland affection [3]. Also known as recurrent acute parotitis or recurrent sialectatic parotitis, JRP is a recurrent non-suppurative and non-obstructive parotid inflammation, generally associated with intermittent painful swelling of one or both glands, often accompanied by redness and fever [4 5]. JRP usually occurs between 3 and 6 years of age and sex distribution favours males, although females are predominantly affected when the disease begins after puberty. Each episode – lasting for a few days up to a couple of weeks – may occur every 3-4 months, even though there are reports of cases with more than 10 events per year [4 6]. Symptoms are most often one-sided; in case of bilateral involvement, the disease appears to be significantly more symptomatic on one side.
Even if JRP usually vanishes spontaneously after puberty, in some cases the disease continues into adulthood, leading to a progressive loss of parenchymal function. Thus, surgery becomes unavoidable [4 5]. Lacking clear scientific evidence, the aetiology is still discussed and multifactorial causes have been suggested [4 7-9]. Diagnosis is achieved after the first attack (often ignored) and provided by careful medical history, clinical evaluation and imaging study. However, in the absence of a widely accepted consensus and universal guidelines, dissimilar diagnostic and therapeutic strategies have been described. Overall, conservative treatments provide an appropriate management of acute symptoms, through analgesics and antipyretic

drugs. The adoption of antibiotics is controversial and restricted to any potential suppurative evolution of inflammatory events. Steroids are administered only to reduce swelling, and no therapies are available to prevent recurrences [4 5 10 11].

The prevention of recurring attacks actually represents the most dramatic and serious aspect of this pathology. Recurrences not only significantly influence the quality of life, but they can also lead to progressive gland destruction, in rare cases though, and consequently to major interventions such as superficial or total parotidectomy [4 5].

In recent years, there have been many reports of international experiences related to the management of JRP by sialendoscopy. This relatively novel and promising device is designed to see inside the ductal system, and offers new perspectives for both diagnosis and treatment of benign salivary gland diseases [12]. In this context, several authors have stressed the striking role of sialendoscopy in prevention of JRP attacks.

Up to now, the emerging use of sialendoscopy in JRP has not been critically analyzed. The objective of the current review is to overview the existing literature with particular regards to diagnostic and therapeutic outcomes after the application of sialendoscopy in patients suffering from JRP.

Technical background

The need to utilize instruments with several technical features (high-resolution optical devices, resistant and easy to handle) has justified the use of different systems over the years. A valid compromise is represented by semi-rigid endoscopes, with intermediate characteristics between their flexible and rigid precursors. The presence in each endoscope of a specific irrigation channel represents the *conditio sine qua non* for ductal dilation and visualization. A working channel is required for the execution of therapeutic procedures beyond simple videoendoscopic exploration. Interventional sialendoscopy requires particular miniaturized tools as forceps, baskets, balloons, graspers, laser fibres and microdrills. Thanks to continuous technological progress, sialendoscopy is now an established procedure for salivary stones and ductal anomalies with recurrent gland inflammations in adult patients [12-15]. For all procedures, the first step is Stensen's papilla identification and dilation, using various types of dilatators. Depending on the latest manufacturers, the overall instrument diameter varies from 0.8 mm (without working channel) to 2.3 mm (with working channel), providing a resolution from 6,000 to 10,000 pixels [16]. Since the ductal paediatric diameter does not appear to be substantially different from that of adults, direct ductal visualization and interventional procedures using the latest generation endoscopes can be performed at any age [17].

Materials and methods

All existing clinical trials published in English and sourced through updated electronic databases (MEDLINE, EMBASE) were examined. The research was performed using the following keywords: "juvenile recurrent parotitis AND sialendoscopy OR sialoendoscopy OR endoscopy", "recurrent acute parotitis AND sialendoscopy OR sialoendoscopy OR endoscopy", "recurrent sialectatic parotitis AND sialendoscopy OR sialoendoscopy OR endoscopy", "paediatric AND sialendoscopy OR sialoendoscopy". Specifically, data concerning diagnostic and therapeutic outcomes in identified studies were reviewed to provide the evidence justifying sialendoscopy in JRP. Levels of evidence were assigned according to the Oxford Centre for Evidence based Medicine [18]. Searches were done at all stages, from the initial drafting of the paper to submission of the revised and final version. Review articles, letters, editorials and case reports were excluded.

Results

Ten clinical trials satisfied the research criteria. The included articles were analyzed and data were acquired to focus on the diagnostic (Table I) and therapeutic (Table II) aspects of sialendoscopy. No randomized controlled studies were found, and all outcomes were based on case series (level of evidence 4 – Table III). Two or more episodes of parotid swelling within 6-12 months were necessary to enrol patients to sialendoscopy after detailed and fully informed consent. Except for Konstantinidis and 20% of Schneider's population [19 22], each procedure was performed under general anaesthesia. The overall population was composed of 179 children (109 males, 70 females), average age 7.8 years, with a high prevalence of monolateral symptoms. The mean frequency of JRP events prior to sialendoscopy was 5.5 attacks per year. When reported, clinical examination always revealed widening of Stensen's papilla. The literature described sialectasia as the most common ultrasonographic (US) finding for diagnosis of JRP (mean 84%). Sialography confirmed sialectasis and identified kinks in one-third of Nahlieli's case series [28]. The most relevant and recognized sialendoscopic finding was the white wall appearance and lack of vascularity in the ductal layer (mean 75%). Furthermore, confined/diffused stenosis and multiple fibrinous debris/mucous plugs were noticed in a high percentage of children (mean 56% and 45%, respectively).

In all cases, interventional sialendoscopy was helpful as a treatment option through ductal irrigation with isotonic saline solution plus steroids. In anecdotic patients, the additional use of microdrills or balloon dilatation was required. A low percentage of children (mean 14%) was submitted to a second or more sialendoscopic procedures. A high rate of success was estimated for each report, with a significant complete resolution ("cured": mean 78%)

Table I. Sialendoscopy & JRP: literature review of diagnostic outcomes.

Authors	No. patients	No. parotid involvement		Mean age (years)	Sex (M:F)	Ultrasound findings (%)	Sialographic findings (%)	Sialendoscopic findings (%)
		Mono	Bi					
Schneider H[19]	15	9	6	7.5	10:5	Heterogeneous glands (100%) Sialectasia (100%)	NA	NA
Capaccio P[20]	14	8	6	7.9	8:6	Heterogeneous glands (100%) Sialectasia (100%)	NA	White ductal wall without vessels (100%) Fibrinous debris/mucous plugs (60%) Stenosis (100%) Kinks (30%)
Hackett AM[21]	12	5	7	9.7	7:5	NA	NA	White ductal wall without vessels (8%) Fibrinous debris/mucous plugs (75%) Stenosis (25%)
Konstantinidis I[22]	6	5	1	9.5	3:3	Sialectasia (100%)	NA	White ductal wall without vessels (100%) Fibrinous debris/mucous plugs (100%) Stenosis (50%)
Gary C[23]	3	3	0	9.0	3:0	NA	NA	White ductal wall without vessels (66%) Fibrinous debris/mucous plugs (66%) Stenosis (66%) Normal (34%)
Martins-Carvalho C[24]	18	NA		9.0	12:6	Heterogeneous glands (46%) Normal (27%) Lithiasis (18%) Sialectasia (9%)	NA	White ductal wall without vessels (100%) Stenosis (100%)
Jabbour N[25]	5	2	3	6.2	5:0	NA	NA	Fibrinous debris/mucous plugs (90%) Stenosis (10%)
Shacham R[26]	70	47	23	6.7	43:27	Sialectasia (100%)	Sialectasia (100%) Kinks (NA%)	White ductal wall without vessels (100%) Strictures & Kinks (NA%)
Quenin S[27]	10	3	7	5.0	4:6	Sialectasia (82%) Lithiasis (18%)	NA	White ductal wall without vessels (100%) Stenosis (100%) Fibrinous debris/mucous plugs (13%)
Nahlieli O[28]	26	20	6	7.0	14:12	Sialectasia (100%)	Sialectasia (100%) Kinks (31%)	White ductal wall without vessels (100%)

No. patients = number of patients with diagnosis of JRP submitted to diagnostic and interventional sialendoscopy
No. parotid involvement = number of monolateral (Mono) or bilateral (Bi) parotid involvement
NA = data not available

or frequency reduction ("improved": mean 22%) of JRP attacks (Table II). Mean operative time was available in only three reports. Hospital stay was noted in three articles (Table II). No major complications or side effects were observed. Hackett et al. described a possible ductal breech during sialendoscopy in a 16-year-old girl. A stent fashioned from a 3-Fr feeding tube was sutured in place with complete recovery 5 days later. The same team reported transient swelling and increased pain that resolved after antibiotic administration [21]. Another two authors reported upper airway obstruction in 11% of patients due to parotid swelling of the pharyngeal gland portion [24 27]. In all cases, such events were self-limiting and resolved spontaneously within 24 hours. Gary et al. documented a relatively high percentage of proximal duct stenosis that required papillotomy incision with subsequent complete "restitutio ad integrum" [23]. None of the published data reported follow-up times longer than 36 months (range 4-36 months). Specific details on type and size of endoscopes used are shown in Table III.

Discussion

The development of minimally invasive procedures has led to profound implications for patient management with recognized significance in the paediatric field. More specifically, sialendoscopy is a relatively novel and promising approach to salivary gland patholo-

Table II. Sialendoscopy & JRP: literature review of endoscopic treatment.

Authors	No. JRP attacks prior	Sialendoscopic treatment (%)	Mean time (min)	Repeated procedures (%)	Success (%)		Mean hospital stay (days)	Complications (%)	Follow-up (months)
					Cured	Improved (No. JRP attacks after)			
Schneider H[19]	7.2	Injection isotonic saline solution/steroids (100%)	NA	13%	NA	NA (2.4)	NA	NA	12
Capaccio P[20]	4.1	Injection isotonic saline solution/steroids/ antibiotics (100%)	20 min	21%	64%	36% (0.2)	NA	0%	30
Hackett AM[21]	5.0	Injection isotonic saline solution/steroids/ antibiotics (100%) Balloon dilatation (8%)	NA	25%	83%	NA (NA)	NA	Possible ductal breech (8%)	10
Konstantinidis I[22]	5.0	Injection isotonic saline solution/steroids (100%)	35.2 min	17%	67%	33% (NA)	0	0%	14
Gary C[23]	5.0	Injection isotonic saline solution/steroids (100%)	NA	0%	100%	0% (0)	1	Proximal duct stenosis (66%)	9
Martins-Carvalho C[24]	NA	Injection isotonic saline solution/steroids (100%) Balloon dilatation (NA%)	NA	17%	78%	NA (NA)	NA	Upper airway obstruction (11%)	24
Jabbour N[25]	7.0	Injection isotonic saline solution/steroids (100%) Balloon dilatation (10%)	NA	20%	60%	40% (2.0)	NA	0%	> 6
Shacham R[26]	6.0	Injection isotonic saline solution/steroids (100%) Balloon dilatation (6%) Microdrill (6%)	NA	7%	86%	13% (1.0)	NA	0%	6-36
Quenin S[27]	4.8	Injection isotonic saline solution/ steroids (100%)	57.0 min	10%	80%	10% (NA)	1	Upper airway obstruction (11%)	11
Nahlieli O[28]	NA	Injection isotonic saline solution/steroids (100%) Balloon dilatation (8%)	NA	8%	92%	NA (NA)	NA	0 %	4-36

No. JRP attacks prior = number of JRP attacks within 1 year prior to sialendoscopy/number of patients

No. JRP attacks after = number of JRP attacks within 1 year after sialendoscopy/number of patients

Repeated procedure (%) = Percentage of patients submitted to a 2nd or more sialendoscopic procedures

Mean time (minutes) = mean time needed for the sialendoscopic treatment

Success (%) = Percentage of patients who had complete symptoms resolution (cured), or frequency reduction of JRP attacks (improved)

NA = data not available

gies where technological advancements have allowed the valuable opportunity to see inside the ductal system. First introduced in the 1990s by Katz et al. [29] in France and Königsberger et al. in Germany [30], salivary gland videoendoscopy became an established procedure after standardization and made widely known by Francis Marchal and Oded Nahlieli [31 32]. Since then, several authors have described sialendoscopy as a suitable device for benign salivary gland disorders with validated effectiveness and safety in adults [12-15 33]. In the last 10 years, many international and authoritative experiences have assessed sialendoscopy for the diagnostic and therapeutic management of JRP [19-28]. High success rates and low morbidity seem to justify the increasing use of sialendoscopy in JRP, even if a comprehensive analysis of documented outcomes has not yet been reported [34].

JRP is the second most frequent salivary gland disease in childhood, defined as a recurrent non-suppurative and

Table III. Sialendoscopy & JRP: general features and level of evidence.

Authors	Published year	Country	Journal	Type of endoscope (outer diameter, mm)	Level of evidence*
Schneider H[19]	2013	Germany	Laryngoscope	Erlangen (0.8, 1.1)	4 (Case-series)
Capaccio P[20]	2012	Italy	J Laryngol Otol	Erlangen (0.8)	4 (Case-series)
Hackett AM[21]	2012	USA	Arch Otolaryngol Head Neck Surg	NA (1.1, 1.3)	4 (Case-series)
Konstantinidis I[22]	2011	Greece	Int J Pediatr Otorhinolaryngol	Marchal (1.1)	4 (Case-series)
Gary C[23]	2011	USA	J Indian Assoc Pediatr Surg	Erlangen (0.8, 1.1) Marchal (1.3)	4 (Case-series)
Martins-Carvalho C[24]	2010	France	Arch Otolaryngol Head Neck Surg	NA (0.9 + Sheath diameter) Marchal (1.3)	4 (Case-series)
Jabbour N[25]	2010	USA	Int J Pediatr Otorhinolaryngol	NA (1.1)	4 (Case-series)
Shacham R[26]	2009	Israel	J Oral Maxillofac Surg	Modular salivascope (0.9-1.1)	4 (Case-series)
Quenin S[27]	2008	France	Arch Otolaryngol Head Neck Surg	NA (0.9 + Sheath diameter) Marchal (1.3)	4 (Case-series)
Nahlieli O[28]	2004	Israel	Pediatrics	Nahlieli (1.3)	4 (Case-series)

NA = data not available
**A level of evidence was assigned in accordance with the study design*

non-obstructive parotid inflammation. At present, its aetiology remains unknown: genetic, infectious, allergic and immune-mediated causes have all been proposed. Diagnosis is achieved after the first attack (often ignored) and achieved by careful medical history, clinical evaluation and imaging study. Among imaging techniques, US is considered the first diagnostic step for salivary gland disorders. From the literature, it emerges that in a relevant number of cases, Martins-Carvalho et al. [24] and Quenin et al. [27], did not report any significant US findings, which were somewhat confusing and puzzling. This again highlights the disadvantages of an operator-dependent procedure. Direct endoscopic exploration permits differential diagnosis among dissimilar causes of obstruction [24 35]. Sialography has been demonstrated to be useful in detecting ductal anomalies, even though its application is limited by the presence of ionizing radiation [28]. Katz et al. published the largest study to date in JRP with an average follow-up of 5.5 years. A total of 840 children suffering from JRP were submitted to sialography with iodinated oils which provided both diagnosis and effective treatment. Complaints recurred in 98% of patients with a symptom-free interval ranging from 6 to 18 months [36]. The most relevant and recognized sialendoscopic finding was represented by a white, avascular and stenotic lining of Stensen's duct. The lack of a natural vascularisation detected sialendoscopically might constitute a possible causative agent to JRP. In particular, an abnormal pattern of vascularization may invalidate the sphincteral system of the parotid gland [28]. The reduced ability to drain saliva would then trigger an inflammatory vicious circle (salivary flow decrease, debris accumulation, obstruction, inflammation) [25], which could lead to more than 10 recurrences per year [6].

The prevention of this domino effect, being the goal of the therapeutic procedure, currently represents a genuine challenge for both surgeons and patients. Sialendoscopy breaks the cycle of inflammation by washing out intraductal debris and dilating stenosis [25]. The striking importance of early diagnosis and efficient therapy to avoid gland destruction [17 36] may justify the need for general anaesthesia in the majority of procedures. Historically, treatment of JRP included conservative or invasive methods, and no preventive therapies were available. Acute events were managed with symptomatic drugs, warmth and massages, sialogogic agents, steroids, antibiotics and duct probing. Even if no study has confirmed the benefit of prophylactic antibiotics during winter or dehydration prevention, all these measures have been attempted to obviate recurrences [4 5 10 11]. Anecdotally, oral appliance/orthotic therapy is another therapeutic effort that has been documented in a small population of children for a short follow-up time [37]. When recurrent attacks continue into adulthood with irreversible glandular damage, invasive procedures are required. Among surgical techniques, Stensen's duct ligation, tympanic neurectomy, superficial or total parotidectomy have been described, while only the latter is curative and associated with high risk including facial nerve damage [4 5 38-41]. Major operations should not

be considered exceptional however: two of the reviewed case series reported medical histories positive for parotidectomy [21 26].

In 179 children reported across 10 studies, complete evanescence of the symptoms after sialendoscopic treatment was observed in 78% of patients and partial regression in 22% of the cases. International experiences have shown the feasibility of paediatric sialendoscopy allowing Stensen's duct examination and secondary duct visualization, when possible. No major complications were documented and the low associated morbidity justified the procedure on the healthy gland [26 28]. A debated question is whether outcomes are the consequences of the natural JRP history or the effects of the procedure itself. Although the physiopathology of JRP is still poorly understood, the high success rate achieved after the first treatment in patients with a relevant number of recurrences and at an average age much far from the expected vanishing limit, supports the positive role of sialendoscopy in JRP prevention. Nevertheless, many factors weaken the strength of the evidence justifying sialendoscopy in JRP:

- all outcomes were based on case series in the absence of a control group and randomization (level of evidence 4);
- relatively small population: considering that some of the Authors belonged to the same centre (e.g. Martins-Carvalho et al. [24] and Quenin et al. [27] to Edouard Herriot University Hospital; Nahlieli et al. [28] and Shacham et al. [26] to Barzilai Medical Centre) there might be some overlap of the analyzed groups;
- results were documented without homogeneous long-term follow-up.

Overall, potential benefits also exist with respect to the limits described above, considering the diagnostic and therapeutic advantages, minimal morbidity and the lack of other recognized options for prevention. The promising impact of sialendoscopy on the quality of life remains a crucial clinical aspect that undoubtedly requires higher levels of supporting evidence.

Conclusions

The encouraging results of the diagnostic and therapeutic role of sialendoscopy emphasize the advantages of this new tool for management of JRP. However, long-term follow-up and randomized prospective studies are needed to verify these outcomes before such benefits can be fully assessed.

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