Results of Minimally Invasive Gland-Preserving Treatment in Different Types of Parotid Duct Stenosis

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Objective: To assess differences in minimally invasive treatment in various types of Stensen duct stenoses, because sparse data have been published concerning this.

Design: Retrospective study.

Setting: Tertiary reference center, level of evidence: 2b.

Patients: Ninety-three patients with stenoses.

Methods: Treatment of 111 parotid duct stenoses was evaluated with particular attention to which treatment strategies were successful in various types of stenoses (type 1, inflammatory; type 2, web-associated fibrous; and type 3, fibrous). Minimally invasive treatment consisted of sialendoscopy-guided rinsing with cortisone (all cases) and interventional sialendoscopy with instrumental dilation alone or combined with transoral ductal surgery.

Results: Sialendoscopy-guided rinsing with cortisone was sufficient in 73.0% of cases of type 1 stenosis (21.5% of all cases). Interventional sialendoscopy with instrumental dilation was successful in 47.1% of cases of type 2 stenosis and 70.5% of cases of type 3 stenosis (59.2% of all patients). Interventional sialendoscopy combined with transoral duct surgery was successful in 72.7% of cases of type 3 stenosis (8.6% of all cases). Glands could be preserved in 96.4% of cases.

Conclusions: Stenoses that can be differentiated using sialendoscopy seem to require different minimally invasive treatment. Sialendoscopy-guided rinsing with cortisone is an important basic anti-inflammatory treatment, particularly in inflammatory stenoses. Interventional sialendoscopy with instrumental dilation, transoral ductal surgery or a combination of both are the first choice in fibrous stenoses.


UPTO75%OFSTENOSESOF
thesalivaryductsarelocatedintheparotidduct,
andthesecauseapproximately15%to25%ofall
unclearsalivaryglanddiseases.1,2Chronic
parotitisisthemajordayoutofthistypeof
stenosis, but associations with allergic, in-
fected, granulomatous, and autoimmune
diseases, as well as status after rad-
iation therapy or radioiodine therapy, have
also been reported.3,5 Ultrasonography is cur-
rently the diagnostic method of choice in
our department. Ultrasonographic imaging
of parotid gland stenosis shows a hy-
poechoic band on the masseter muscle, as
evidence of dilation of the ductal system,
and also hypoechoic parenchymal changes,
as signs of obstruction of the gland.6

Stenoses can be directly and safely vi-
sualized using sialendoscopy, which al-
lovasessmentofthecharacteristicsofthe
tissue and the extent of the stenosis.5,7 Si-
ialendoscopy also allows precise evalua-
tion and classification of the stenosis. Three
different types of stenoses have been de-
scribed: inflammatory (type 1); fibrous, as-
associated with intraductal circular or web-
lke inclusions, often with only a moderate
degree of luminal narrowing (type 2); and
fibrous, involving the entire ductal wall, al-
mast always with high-grade to complete
obstruction (type 3).3 Parotid duct steno-
nes are difficult to treat, and the results have
so far been unsatisfactory in most cases.
Only a few publications have described the
treatment of these stenoses.6-10 By con-
trast, there have been numerous reports on
the treatment of chronic parotitis, experi-
enence with which therefore also needs to be taken into account.3,11

Conservative anti-inflammatory treatment can improve the symptoms in approximately 50% of cases,2 and it may include adjuvant measures, such as rinsing with saline or contrast medium during sialography,12,13 as well as intraductal administration of various drugs.12,14 More invasive measures, which are necessary in approximately 40% to 50% of cases,3,11 include ligation of the efferent duct and various surgical procedures in the distal ductal system.3,11,15-17 Even in more recent publications, however, parotidectomy is still considered to be unavoidable in up to 40% of cases.3,11,18-20

The development of miniaturized instruments and new treatment methods has led to a fundamental change in treatment approaches during the past 10 years. New methods include radiographically and sialographically controlled balloon dilation, which has been performed with a success rate of approximately 80%.2,6,23 Sialendoscopy allows endoscopically guided treatment of pathologic changes in the ductal system with direct visualization, after the introduction of miniaturized surgical instruments through the working channel.7,8,21-23

After categorizing 111 symptomatic stenoses of the parotid duct in 93 patients,3 this retrospective study reports on our experiences in the treatment of these stenoses in the same group of patients, with special attention to the value of various treatment procedures in relation to the various types of stenoses.

METHODS

A total of 111 stenoses of the parotid duct in 93 patients were treated during the period from 2001 to 2006. Forty-three percent of the patients were men (40 of 93). The patients’ average age was 49 years (range, 15-75 years; median, 49 years). Isolated stenoses were present in 87.1% of cases (bilateral in 6.57%), and in 12.9% these were also associated with sialolithiasis.

All of the patients were examined using high-resolution ultrasonography (Sonoline Elegra, 7.5 MHz; Siemens Medical Solutions USA Inc). Sialendoscopy was performed after the suspected diagnosis had been made clinically and on ultrasonography. In addition to direct visualization, this allowed pretherapeutic assessment of the stenosis.3 The endoscopy set used currently includes 3 sialendoscopes with outer diameters of 0.8 to 1.6 mm. The most important instruments for treatment with direct endoscopic guidance were baskets, miniature forceps, microdrills, and balloons (with diameters ranging from 0.38 to 0.78 mm).5,6,21

The treatment was mainly based on the sialendoscopic findings. The basic treatment performed in all patients consisted of endoscopically guided conservative therapy, with rinsing of the ductal system using Ringer solution mixed with prednisolone, 250 mg. Treatment for the stenosis was performed in accordance with the tissue quality and grade of luminal narrowing. The various diameters of the sialendoscopes were used to assess the degree of stenosis. Low-grade stenoses were passable with the 1.1-mm endoscope but not with the 1.6-mm endoscope; moderate stenoses easily passable with the 0.8-mm endoscope and with forced power by the 1.1-mm endoscope; and high-grade (filiform or complete) stenoses were not passable with the 0.8-mm endoscope. Stenoses with slight to moderate luminal constriction, and inflammatory stenoses in particular, which could still be passed with the endoscope under slight pressure, did not represent an indication for further instrumental dilation (Figure 1). By contrast, interventional sialendoscopy with instrumental dilation was always indicated for high-grade filiform to complete stenoses.

The stenoses were dilated under direct vision until the lumen was wide enough (ie, >1 mm) to be passed with the 1.1-mm sialendoscope and unobstructed salivary flow was possible. Dilation with the miniature basket is a proven technique here for atraumatic bougienage of inflammatory or fibrous stenoses (Figure 2). The basket and microdrill allowed cicatricial filiform or complete stenoses to be opened or reamed to restore a patent ductal lumen (Figure 3).

In papillary or distal ductal stenoses, in which insertion of the sialendoscope or interventional sialendoscopy was not possible, minimally invasive transoral ductal surgery was performed (papillotomy, distal ductal incision, ductal resection, and reinsertion), with sialendoscopically guided stent placement where appropriate. The extent or length of complete distal papillary or ductal stenosis was previously measured precisely using ultrasonography. The threshold at which transoral ductal surgery treatment was indicated was a maximum length of 1.0 to 1.5 cm.9

Combined treatment for stenoses with interventional sialendoscopy and an open transcannular access route has been

Figure 1. Type 1 stenosis. Before treatment (A) and 3 months after treatment (B). Treatment consisted of dilation by the endoscope itself and intraductal cortisone therapy during and after the intervention.
described, but this was not indicated in the group of patients treated in the present study.

After the intervention, all patients received naproxen sodium (Proxen), 2500 mg/d, for further anti-inflammatory therapy. If there were marked inflammatory changes, an antibiotic was prescribed; for example, roxithromycin (Rulid), 300 mg/d, or ampicillin with sulbactam (Unacid), 1 g/d. Regular daily gland massage after stimulation of gland secretion with sialogoga (eg, ascorbic acid) was recommended, which should be continued also after cessation of the symptoms.

Intraductal administration of single doses of prednisolone, 50 mg, was also performed after every intervention (current scheme: once a week for 8 weeks, twice a week for 4 weeks, and once a week for a further 4 weeks; total treatment time, 4 months).

Parotidectomy was recommended as the treatment of last resort if symptoms persisted. The mean follow-up period was 27.2 months (range, 3.0-80.0 months; median, 23.5 months).

RESULTS

Sialendoscopy was performed with local anesthesia in 92 patients (98.9%). No complications occurred either during the procedures or during the subsequent course.

In 4.3% of the patients, insertion of the endoscope was possible only after surgical opening of the papilla or distal ductal system in patients with papillary or distal ductal stenoses (4 of 93; all type 3 stenoses and treated by transoral ductal surgery) (Table).

Multiple sialendoscopic examinations (a maximum of 4) were performed in 27.9% of the patients (26 of 93). Both glands were examined endoscopically in 6 patients, and bilateral interventional sialendoscopy was performed in 3 cases. Sialendoscopy plus cortisone therapy (CT) was performed in 22.5% of the patients (21 of 93), and this treatment alone was sufficient in 21.5% (20 of 93) (Figure 1).

In 74.2% of the patients (69 of 93), attempts were made to dilate the stenosis using interventional sialendoscopy (with a total of 85 procedures; up to 3 procedures in 10 patients, bilateral in 3). Intervventional sialendoscopy was the only treatment modality performed on 65.6% of the patients (61 of 93), in whom 76 sialendoscopy procedures were performed, 88.2% of which (67 of 76) were successful. In all, 59.2% of the patients (55 of 93) were successfully treated with interventional sialendoscopy (Figure 2 and Figure 3). Minimally invasive transoral ductal surgery was performed in 11.8% of the patients (11 of 93), all with type 3 stenosis (4 patients with cicatricial complete papillary stenosis, 5 with extensive scarring and complete obliteration of the duct just after the papilla, and 2 patients

Figure 2. A type 2 stenosis before treatment. This fibrous stenosis shows moderate obstruction (white arrow). A, The parotid duct is massively dilated, creating a megaduct (>10 mm). B, The stenosis is also visible externally (black arrows). C, Treatment consisted of basket dilation and intraductal cortisone therapy during and after the intervention. D, Status 3 months after treatment.

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with unsuccessful interventional sialendoscopy) (Table). Resection of the papilla and distal duct, followed by circular reinsertion of the duct into the buccal mucosa, was performed in 3 patients, in 1 case with stent placement. This treatment was successful in all cases. Incision of the papilla and distal duct system was performed in 8 patients, and a stent was also placed under endoscopic guidance in 6 of these patients (54.5%). Five of the patients became free of symptoms. The success rate with transoral ductal surgery was 72.3% (8 of 11) (Table). A further 8.7% of all patients were successfully treated with interventional sialendoscopy, with or without transtral ductal surgery.

Stents were placed in 8.6% of the patients (8 of 93) when there was an increased risk of recurrence, but they were placed in only 2.2% (2 of 93) after interventional sialendoscopy alone (Figure 3). The stents, made of polyurethane, are available with various lengths (20-120 mm) and diameters (4.5F-6.0F) and fit precisely over the shaft of the various endoscopes in the Erlangen endoscopy set (patented by Sialo Technology Israel Ltd). The stents were sutured to the buccal mucosa and left in place for 6 to 8 weeks. Correct positioning in the ductal system was always checked intraoperatively by sialendoscopy and also postoperatively using ultrasonography. In all, 95.1% of the patients with type 3 stenoses needed and received minimally invasive surgical treatment.

With regard to the individual treatments administered in relation to the different types of stenosis, 73.3% of type 1 stenoses (11 of 15) were treated with sialendoscopy, 26.7% (4 of 15) with interventional sialendoscopy alone, and 13.1% (6 of 46) with transtral ductal surgery and stenting. In 6.7% of type 1 stenoses (1 of 15) a stent was placed after intervention alone. In 0 of 15 patients a parotidectomy was performed.

Table. Parotid Duct Stenoses: Characteristics, Number, Treatment, and Course in 93 Patients With 111 Stenoses

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Type 1, Course</th>
<th>Successfully Treated</th>
<th>Unsuccessful/ Symptomatic</th>
<th>Type 2, Course</th>
<th>Successfully Treated</th>
<th>Unsuccessful/ Symptomatic</th>
<th>Type 3, Course</th>
<th>Successfully Treated</th>
<th>Unsuccessful/ Symptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE + CT</td>
<td>60.0 (9 of 15)</td>
<td>6.7 (1 of 15)</td>
<td>47.1 (8 of 17)</td>
<td>47.1 (8 of 17)</td>
<td>0 (0 of 17)</td>
<td>4.9 (3 of 61)</td>
<td>0 (0 of 61)</td>
<td>70.5 (43 of 61)</td>
<td>6.6 (4 of 61)</td>
</tr>
<tr>
<td>IntervSE</td>
<td>26.7 (4 of 15)</td>
<td>6.6 (1 of 15)</td>
<td></td>
<td>47.1 (8 of 17)</td>
<td>5.9 (1 of 17)</td>
<td>13.1 (8 of 61)</td>
<td>4.9 (3 of 61)</td>
<td></td>
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<tr>
<td>TDS ± intervSE</td>
<td></td>
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Abbreviations: CT, intraductal cortisone therapy; intervSE, interventional sialendoscopy; SE, sialendoscopy; TDS, transoral ductal surgery.

aData are given as percentage (number/total number). Type 1 is inflammatory; type 2, fibrous and web associated; type 3, fibrous, without webs.
bParotidectomy in 2 patients.
cParotidectomy in 1 patient.

Figure 3. A type 3 stenosis in the middle area of the duct before treatment. A, Stenosis showing almost complete fibrous obstruction. B, A basket was inserted to dilate the fibrotic tissue step by step. C, A microdrill (white arrow) was used to cut the fibrous tissue and the stenosis was further opened. D, After instrumental dilation, severely macerated ductal epithelium at a length of 1.5 cm with fibrotic tissue involving more than 50% of the circumference was observable indicating a high risk for recurrence. E, Endoscopically guided stent implantation was performed: a polyurethane stent, 4.5F, 60 mm, was inserted in the healthy proximal duct system (black arrow). F, Two months later control sialendoscopy was performed: after removal of the stent, an epithelialized duct system was observable, which was wide enough to allow unhindered passage with the 1.1-mm endoscope.
Obstructive diseases in the parotid gland are associated with considerable impairment of the quality of life for the patients affected. Stenoses of the parotid duct are found in approximately 20% of cases in patients with obstructive parotid gland disease and represent 70% to 80% of all salivary duct stenoses. Treating these stenoses is often problematic in everyday practice. Chronic parotitis, which seems to be one of the major causes of duct stenosis, was reported to be treatable only with more invasive forms of therapy, including parotidectomy, in 40% to 50% of cases, even according to the more recent literature reports.

Conservative systemic treatment measures and intensified local treatments allow a temporary reduction in clinical symptoms in approximately 50% of cases.

The development of minimally invasive treatment protocols has made it possible to relieve the symptoms permanently with minimal morbidity while preserving the function of the salivary gland. These methods include radiographically guided dilation of the salivary ducts, with success rates higher than 80%. In addition to allowing assessment of the tissue characteristics in the area of the stenosis, sialendoscopy at the same time allows appropriate therapy, with direct endoscopic guidance, based on the sialendoscopic findings. Sialendoscopy thus allows both diagnosis and simultaneous treatment with direct vision. Success rates of more than 90% have been reported for endoscopically guided dilation of parotid duct stenoses.

Sialendoscopy played a decisive role in the treatment approach used in this study. Precise sialendoscopic characterization of the stenoses was important for planning and carrying out the appropriate treatment. With sialendoscopy-guided rinsing with cortisone, symptomatic control was achieved in 21.5% of the patients through the anti-inflammatory effect alone and the dilatory effect of the endoscope itself. This was seen in 60% of the type 1 stenoses and 47.1% of the type 2 stenoses (Figures 1 and 2; Table). Particularly in stenoses in which there is a clear inflammatory reaction, an expectant approach avoiding or minimizing surgical manipulation seems to be justified. In addition, progression (eg, from type 1 to type 3 stenosis) is imaginable and can be prevented at an early stage in this way.

While interventional sialendoscopy was performed in only in 33.3% of the type 1 stenoses, it was necessary in 52.9% of the type 2 and 77.1% of the type 3 stenoses (Figures 2 and Figure 3; Table). It was possible to dilate the stenoses in 88.2% of the interventional sialendoscopies performed, and 59.2% of all patients were successfully treated with this method. These results, as well as those reported by other research groups, show that endoscopically guided therapy is the treatment of choice for parotid gland stenosis.

However, a wide range of procedures are needed to maximize the numbers of successful treatments. These include transoral ductal surgery and, in particular, resection of the distal duct with reinserterion. In combination with transoral ductal surgery, as many as 95.1% of cases of type 3 stenoses could be treated. Particularly when interventional sialendoscopy is not possible or is unsuccessful, these procedures offer a solution in cases of complete distal ductal stenosis, which represented as many as 11.8% of cases in the present group of patients—all with type 3 stenosis. Interventional sialendoscopy is required to exclude or treat additional pathologic changes and to perform the endoscopically guided stent placement that is often required (54.5% of cases after transoral duct surgery in the present study). The success rates in this study (72.3% of all transoral ductal surgery procedures or 8.6% of all patients) are better than results pre-
viously published in the literature. These procedures are reported as failing in up to 70% of cases in some publications, particularly owing to a tendency toward scarring in the papillary region.\textsuperscript{3,11,14-17,19} Adequate surgical technique and interventional sialendoscopy with stent implantation evidently lead to a substantial reduction in the risk of recurrent stenosis.\textsuperscript{7,15} According to Cohen et al.,\textsuperscript{15} resection of the stenotic ductal segment and complete circular suturing of the residual duct into the buccal mucosa and establishing a wide neo-ostium is seen as being the key to success in these cases. The results of the present study confirm this: all patients (n = 3) who underwent ductal resection with reinsertion became free of symptoms. All of the patients who were not free of symptoms (n = 3) were treated with distal ductal incision. In the latter cases, stent placement may reduce the risk of recurrent stenosis considerably, but it does not exclude it completely.\textsuperscript{6,7}

In all patients, repeated intraductal cortisone application was performed. Cortisone is well known to have anti-inflammatory and antiproliferative effects on tissues. In nearly all cases with chronic obstructive parotitis in the involved duct systems, a subacute (or acute) or chronic inflammatory reaction and fibrinoid discharge of various amounts and plaques can be observed with the sialendoscope.\textsuperscript{3,4,25} Plaque formation can cause repeated duct obstruction, which apparently has proved not to be bacterially induced.\textsuperscript{3,4,25} As a result of its anti-inflammatory activity, cortisone is supposed to counteract this primary inflammatory activity, and antibiotic treatment proved not to be the treatment of choice.\textsuperscript{3,0,25} However, exacerbation of inflammation can occur as a result of bacterial superinfection owing to duct obstruction indicating antibiotic therapy. Several study groups reported that inflammatory, noninfectious processes were also involved in the development of stenoses.\textsuperscript{3,4,7,25} Obstructing plaques (eg, a nearby encroachment, duct bending, or duct division) were observed to induce a local inflammatory reaction, causing shrinkage and fibrosis of the duct wall.\textsuperscript{3,4,25} Our observations point in the same direction.\textsuperscript{5,6} The observed effect to reduce the tendency to develop a primary or recurrent stenosis after cortisone treatment also was attributed to its anti-inflammatory and antiproliferative, scar-inhibiting effects in retrospective analysis.\textsuperscript{3,6,7,25} This, of course, has to be investigated by further controlled studies.

Gland massage after stimulation of gland secretion with sialogoga (eg, ascorbic acid) was strongly recommended in all patients in a personal conversation. Daily performance of this was intended to clear the fibrinoid discharge out of the duct system and reduce or prevent of plaque formation and duct obstruction in the future.

The fact that gland-preserving treatment was possible in 96.8% of the patients in the present study, with 92.2% of the patients reporting no relevant symptoms afterward, argues in favor of the treatment regimen described herein, adapted to the different types of stenoses. These results, as well as other published studies,\textsuperscript{6,4-6} show that parotidectomy should no longer be regarded as part of the routine range of treatments for parotid duct stenoses and should be indicated only in individual cases.

In conclusion, these results show that minimally invasive treatment for parotid duct stenosis is possible with a high success rate. Pretherapeutic sialendoscopy allows precise assessment of the stenoses, and the combination of various treatment modalities that may be needed is decisive for success. However, interventional sialendoscopy plays by far the most important role here and should be the treatment of choice. Different measures may lead to success, depending on the type of stenosis involved. It was possible to manage most type 1 stenoses and approximately 50% of type 2 stenoses using sialendoscopy-guided rinsing with cortisone. Type 3 stenoses had to be treated with interventional sialendoscopy, transoral ductal surgery, or a combination of both in over 90% of cases.

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Author Contributions: All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Acquisition of data: Koch, Klintworth, Psychogios, and Zenk.

Analysis and interpretation of data: Koch and Zenk.

Drafting of the manuscript: Koch.

Critical revision of the manuscript for important intellectual content: Koch, Iro, Klintworth, Psychogios, and Zenk.

Statistical analysis: Klintworth and Psychogios.

Administrative, technical, and material support: Koch.

Study supervision: Iro and Zenk.

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