The Lacrimal Outflow in Children

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The increasing importance of nasosinusal endoscopic surgery, has determined that the lacrimal outflow approach in adults is carried out endoscopically more frequently than using the classical Totti's external approach. The same tendency is taking place in children, although in a slower way, since although in them lacrimal outflow pathology is very frequent, in most cases it is usually solved with as simple a procedure as a probing of the outflow.

For the correct handling of a specific pathology, it is usually not adequate to control only an exclusive part of it, for example surgical treatment and it is important to know the diagnosis and treatment. This is especially true in the handling of the lacrimal outflow in children, for whom a certain series of circumstances must be considered, such as a more difficult exploration or the existence of a banal pathology that can be easily corrected either spontaneously or with simple procedures but which could become chronic through inadequate handling. Ideally the collaboration between ophthalmologist and otorhinolaryngologist, must enable the best results. If this collaboration does not take place, the ophthalmologist may tend not to operate on his patients for years and the otorhinolaryngologist will hurry in operating children who could be healed in a simpler way.

Lacrimal system anatomy and physiology.

The lacrimal film enters the drainage system by the lacrimal points of the medial edges of the upper and lower eyelids. They are orifices with a diameter of approximately 0.3mm which are slightly tilted towards the eye to facilitate contact with the lacrimal film. From the lacrimal points, the drainage continues by the inferior and superior ducts parallel to the edge of the eyelid. Most individuals usually have a short common duct before entering the lacrimal sac through the Rosenmüller's valve. The lacrimal sac occupies the lacrimal fossa, formed by the lacrimal bone and the maxillary frontal process. The medial cantal ligament is originated in the anterior lacrimal crest and passes in front of the upper portion of the lacrimal sac. The sac is covered by a superficial layer of columnar epithelium and a deep layer of globe cells which produce mucus. This same epithelial layer continues through the entire nasolacrimal conduit which goes downwards, back and laterally from the lacrimal sac. The nasolacrimal conduit crosses a short bony channel to end in the nasal fossa, under the concha nasalis inferior, through the Hasner's valve.

Clinical Entities

Atresia of the lacrimal point

Failure in the development of the permeabilization of the anterior portion of the nasolacrimal membranous conduit. Clinically, it is limited to lacrimal accumulation and overflow (epiphora). Mucopurulent secretion does not take place or is minimal. Often only a fine tissue membrane exists which obstructs the duct, requiring only a slight puncture and expansion with a needle to solve the problem. In other cases, the atresia is greater and more complicated surgery is required: incisional puntoplasty combined with bicanalicular intubation, dacryocystostomy with reconstruction of the lacrimal point or conjuntivodacryocystostomy in extreme cases.

Supernumerary lacrimal points

Does not require treatment.

Congenital lacrimal fistula

It is not frequent. It consists of a conduit covered by epithelium which extends from the common duct or lacrimal sac to the cutaneous surface of the inferior eyelid, generally inferomedial to the medial edge. Clinically there is usually a mucous discharge associated to the obstruction of the nasolacrimal conduit. The problem is usually resolved when the nasolacrimal conduit is made permeable. If the problem persists, its complete surgical excision is required.

Dacryocystocele

It is not frequent. It consists of a cystic expansion of the lacrimal sac by the obstruction of the upper and lower drainage of the sac. The inferior obstruction is usually membranous, very similar to that which takes place in the congenital obstruction of the conduit. The mucus is thought to originate from a secretion of the globe cells of the sac. It rarely appears bilaterally.

Clinically it appears as a bluish bulging, approximately 1.0 cm in diameter, located below and medially to the middle edge. Although its aspect is usually typical, a differential diagnosis with haemangioma, dermoid cyst and/or encefalocele must be carried out. It can present protrusion of the nasal fossa, occasionally compromising breathing. This intranasal finding can also be observed in some cases with obstructions of the nasolacrimal conduit without the apparent existence of dacryocele. If the case is not resolved spontaneously, the dacryocele will become infected, generally after a few weeks. If it is not infected, it is can sometimes be decompressed by digital massage combined with topical antibiotics. The lacrimal outflow probing must be made during the first month of life. Once dacryociscytis sets in, systemic antibiotics must be used, requiring surgical drainage in most the cases. This drainage can be carried out channelling the outflow with a lacrimal probe reaching the sac, but for its permanent correction it is preferable to eliminate the lower obstruction. The drilling of the channel in its distal to the coat segment can be made more difficult by the anatomical alterations that usually accompany dacryocele. Sometimes there is no other solution than the endonasal approach and its marsupialization. The cutaneous approach to drain an infected dacryocele should be avoided due to the risk of creating a permanent fistula.

Congenital obstruction of the nasolacrimal conduit

It occurs due to the persistence of a fine membrane in the distal end of the nasolacrimal

conduit. Clinically it is present in 5% of newborn. The symptomatology usually shows towards the first month of life in 90% of cases. It usually consists of epiphora and persistent mucopurulent discharge. The intensity of the clinic varies according to the days, but it does not disappear completely until the obstruction is resolved. There is no erythema of the skin of the eyelids or the conjunctive. Digital pressure on the sac usually produces a mucopurulent flow, although not always. Bilateral affectation is not infrequent, especially in small children. Generally, the case produces only discomfort, although occasionally there can be a secondary bacterial infection with severe conjunctivitis or dacryocystitis, or even cellulitis. Visual function is not affected.

The **differential diagnosis** of the congenital obstruction of the nasolacrimal conduit includes atresia of the lacrimal point, conjunctivitis, blepharitis and congenital glaucoma. The instillation of fluorescein at 2% in the lacrimal film, will detect retention after 5-10 minutes, with failure of nasal or pharyngeal tinction after 10-15 minutes.

The **conservative treatment** is usually initiated by the paediatrician by the administration of antibiotics 1-4 times a day in drops or cream and the digital massage of the sac. The obstruction is usually solved spontaneously or after conservative treatment in 50-90% of patients during the first 6 months of life. A child with positive symptoms at 6 months has a 70% chance of being asymptomatic after a year. After the first year, the possibility of spontaneous resolution descends drastically. In cases of persistent clinic, the probing of the conduit becomes necessary. This can even be carried out with topical anaesthesia up to 12 or 15 months of age, although success is lesser once the age of 6 months has been passed. It is possible to use general anaesthesia for the probing after the age of 6 months and it is absolutely necessary after 15 months. The decision about the moment of drilling is debatable. Early drilling at 3-6 months reduces the time discomfort, the need for conservative treatment and the risk of secondary infections. The intervention does not require a surgical room and can be made in consultation in a relatively simple way, reducing the risks of general anaesthesia. The success of correct drilling of the conduit is better than 90% eliminating the clinic in children under a year. Afterwards, the failure increases.

Surgical treatment of the congenital obstruction of the nasolacrimal conduit

If it is carried out in consultation, it is necessary to suitably restrain the child with a sheet and instil a few drops of topical anaesthetic. If carried out in the operating theatre, it is usually enough with the inhalation of the anaesthetic agent, although some anaesthetists prefer intubation. The sacs are drained by digital massage before the lacrimal drilling, and the edges of the eyelid are cleaned of secretions. One of the lacrimal points, upper or lower, is dilated. The lower point is chosen for greater ease. The best instrument to dilate is a specially designed dilator with fine and blunt end and with a diameter that is gradually enlarged. A Bowman probe is introduced up to the sac by the ducts parallel to the edge of the eyelid, pulling the eyelid upwards and outwards exerting some tension. If there is a firm resistance, the probe should be removed slightly and then attempted again changing the direction until the outflow is found. If even the drilling is still not

possible, it can be tried with the other lacrimal point. The sensation of "touching" the bony wall covered by the mucus of the sac is typical. If on the contrary a spongy structure at the end of duct is "felt", the probe is probably hooked in a prominent Rosenmüller's valve, and should be crossed with care using traction of the eyelid. When the probe contacts the bone, it is pivoted 90º downwards within the nasolacrimal conduit, with a slight inclination back and outwards. Generally, a characteristic "pop" or sensation of exceed a limit is felt when the inferior edge of the conduit is exceeded. Feeling how small resistances are broken with the passage of the probe is common.

The distance from the lacrimal point to the floor of the nasal cavity is approximately equal to the distance between the point and the external prominence of the nose, which is usually smaller than 3.0 cm in children under 1 year. The probe can be inspected using a nasal endoscope to verify its correct placement. After removing the probe, the lacrimal outflow can be irrigated with physiological serum without or with fluorescein, to help in confirming the success of the procedure.

Sometimes a bony resistance is found during the drilling that cannot be surpassed and it will prevent a successful drilling, although it rarely happens. More often in inexperienced hands, the probe is erroneously oriented towards soft tissue or the maxillary cavity. If this happens, it is preferable to abort the operation and to attempt it on another occasion. The most frequent complication is the passage of the probe into the nasal cavity by the outside of the real nasolacrimal conduit. The "**false outflow**" can take place by a defective manipulation of the probe or anatomical variations that make it impossible for a straight instrument to avoid them. It is difficult to detect the creation of a false outflow intraoperatorily. Generally, it is suspected when the procedure is more aggressive than usual, when bleeding occurs or when after a drilling the same clinic persists or a greater difficulty or impossibility in successive drillings. The drilling usually produces an almost immediate improvement in patients, although it is maximal in one or two weeks. On the other hand, recurrence usually takes place before a month after the surgery. Sometimes the patient improves very much after the drilling, but episodes of epiphora and nasal mucus persist, especially in cold days or in cases with high outflows. It could be a permeable conduit but with a partial stenosis that overflows when it has an excessive load. The case generally improves with time and does not require treatment.

In case of failure of the lacrimal drilling, it is advisable to repeat it after a few weeks. In these cases the drilling can be completed with a dislocation of the concha nasalis inferior which is located supported against the side wall of the nose and that may prevent the lacrimal flow.

If the drilling has failed on two occasions (it has been possible to carry it but the clinic remains), bicanalicular drilling with silicone tubes is indicated. Both nasal ends should be tied to prevent their retrograde entry into the nasolacrimal conduit. The intubation with silicone is usually left for 6 months to ensure the permeability of the conduit after the extraction, although it is possible to remove them sooner. Dacryocystorhinostomy will be considered in a minority of cases in which the intubation is not possible or a repeated persistence of the symptoms exists six months after the removal.

Endoscopic Dacryocystorhinostomy

Indications

Most of the very frequent problems of the lacrimal outflow in children are solved spontaneously or with procedures such as simple probing. For this reason, we will rarely carry out a procedure in children under 1 year, except in the case of dacryocystocele, which is not too frequent, in which the endoscopic approach is unacceptable. Except for this case the dacryocystorhinostomy (DCR), external or endoscopic, is indicated when with the diagnosis of a distal obstruction of the lacrimal sac (postsacal obstruction) other simpler procedures have failed. Its indication in time depends on the severity and the type of clinic. Therefore it only presents epiphora more time can be allowed for its spontaneous correction, which is rare after the first year. If on the contrary the clinic is fundamentally repetition dacryocystitis, action should be taken as soon as possible since the diagnosis of post sacal obstruction is clearer and the clinic more severe. Another clear indication is an acute episode of dacryocystitis that is not controlled with antibiotics. The drainage by intranasal outflow does not leave scars or cutaneous fistulas which are the complications that counterindicate the external drainage.

Endoscopic DCR: Surgical Technique

It is identical to that of an adult, except in the preoperating evaluation which is more difficult by the lack of collaboration of the child. Frequently there is only the reference of previous probing or probing attempts. Once the child is asleep and after arranging an intranasal sponge with vasoconstrictor, the eyelids are explored, locating the lacrimal points, evaluating their location and permeability. They may be closed congenitally or as a result of previous manipulations. Both ducts will be dilated and probed and a a drilling up to the nasal cavity will be attempted atraumatically. If this is possible and had not been done previously, a bicanalicular probe will be prepared and the intervention will be concluded.

If it is not possible, or has been attempted previously without success, the procedure will be continued with intranasal exploration, developing a flan of the mucose that is developed in front of the head of the concha nasalis media with the aid of a Freer separator. The procedure is made with endoscopes of 4mm of 0º or 30º. The endoscopes of 2.7mm are of little use when some blood exists, since they do not allow sufficient vision. It is recommended to separate the concha nasalis slightly and to locate the uncinated process, and the maxillary line, in front of which is the area of bone to be resecated in order to locate the lacrimal sac. The bone in this area is resecated easily with Kerrison's hypophisis. In children the bone is usually thinner and softer than in adults, which is why occasionally the use of channelled chisel makes the procedure faster. For the location of the sac once the first cases have been carried out, the anatomical references are usually sufficient, although the simple canalization of the outflow with a Bowman probe making it progress until its makes an imprint in the lacrimal sac that we can be seen from the nasal cavity, allows any doubts to be cleared. Once the sac is located, it must be exposed widely, especially in its anterior and medial sides. Later it will be opened with the aid of a corneal bistoury or Belluci scissors and/or a sickle bistoury for endoscopic surgery or a simple Nº 11 bistoury. The opening of the sac,

which is not always easy, must be frank, allowing a resecation of its medial side. Frequently, at this moment it is possible to appreciate the appearance of purulent material. Later, bicanalicular silicone probes will be set, tied intranasally and fix with tape to the back of the nose during the first days when treating older children. In small children, it is preferable to maintain it intranasal to avoid its manipulation. Finally a minimum nasal obstruction will be arranged, to be removed after 24-48 hours. During the post operation, antibiotic drops in the eyes and nasal washes with physiological serum as well as a topical steroid by the nose should be used at the same time asking the mother to carry out a massage in the internal edge of the operated eye. It is important not blow the nose during the first few days, to avoid the appearance of subcutaneous emphysema. The cures in small children are difficult at the consulting rooms, but they will not be carried out under general anaesthesia. The probes are removed at consultation rooms after one month or month and a half since the intervention when an endoscopical evaluation or, if this is not possible, when it is considered that the healing process of the intranasal orifice has concluded.

Results

The endoscopic DCR is an easily learned technique. The results are generally good at least as much as the external outflow. The cases of failure are related with a bad indication (the problem is not located postsacally) or with an incomplete technique (inadequate opening of the lacrimal sac, milling of the bone burning it by lack of irrigation).

Recommended readings

1. Tomás M y Tomás, S Vía lacrimal en niños. En Manual de Otorrinolaringología pediatrica. Ponencia de la SEORL Madrid 2000
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4. Bernal-Sprekelsen M, Massegur Solench H,Tomas Barberan M. Paediatric endoscopic sinus surgery (PESS): review of the indications. Rev Laryngol Otol Rhinol (Bord). 2003;124(3):145-50.