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Long-term results of submandibular duct transposition for drooling

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Abstract
This study examines the long-term results and morbidity of submandibular duct transposition in drooling children. Twenty-two patients, aged 3 to 18 years, with neurological dysfunction and excessive drooling underwent submandibular duct transposition between 1984 and 1987. In January 1990, 20 patients were reviewed. Their degree of drooling pre-operatively, immediately post-operatively and currently was assessed. The rate of improvement and the occurrence of complications were noted. Drooling was 'much better' in the early post-operative period in 17 of the 20 patients, and this improvement was invariably noted within three weeks. In the three other patients drooling was 'better'. Deterioration occurred in only three patients over the entire follow-up period. Complications all occurred in the first 18 months following surgery; they consisted of salivary retention cysts in four and transient submandibular gland swelling in a fifth patient.

Introduction

Excessive drooling is a common problem in patients with cerebral palsy and in some other forms of cerebral dysfunction. Consequences of this distressing condition include social isolation and a need for repeated changes of clothes or the wearing of bibs. Dehydration is rare, but skin maceration around the mouth or chin is commonly seen (Bailey, 1988). The use of newly developed electrical communication aids is compromised when drooling is marked owing to the dangers involved.

Several modes of treatment, both surgical and medical, have been described and these have recently been reviewed by Bailey (1988). Transposition of the submandibular ducts was first described in the English literature by Ekedahl (1974). The technique was that used by Laage-Hellman (1969) with the addition of ligation and division of the main duct from each sublingual gland. The method used in this study is essentially that described by Crysdale (1980, 1982; Crysdale and White, 1989), however, tonsillectomy is not routinely performed, nor are prophylactic antibiotics prescribed. The technique used by Guerin (1979) involving incising the mucosa overlying part of the length of the ducts has not been found necessary. Two studies reported in the dental literature (Cranin and Bennet, 1982; Fear *et al.*, 1988) use this technique with the addition of sublingual gland excision. Cranin and Bennett (1982) introduced the term 'sialodochoplasty' for submandibular duct transposition.

Several studies have followed up patients over relatively short periods but none has looked at the long-term results in a large group of children. Although attempts have been made to measure the quantity of saliva drooled pre- and post-operatively with radiolabelled isotopes (Ekedahl, 1974) and semi-quantitatively using scoring systems (Crysdale and White, 1989), the response to treatment as determined by questioning patients' carers is the method most widely used for the analysis of results.

Methods

The records of all children or young adults less than 18 years of age who had undergone submandibular duct transposition for drooling at least two years previously were obtained. The age and neurological diagnosis of each patient were noted and the time since operation determined. In January 1990, the parents or regular carers of the patients were contacted by telephone by the authors. They were asked to assess the severity of drooling pre-operatively, immediately post-operatively and at the time they were contacted, in terms of bib counts if possible, but also subjectively. Based on the results of these enquiries, the immediate and delayed results of the procedure were established. Crysdale's subjective criteria of improvement (Crysdale and White, 1989), which categorize outcome as 'excellent', 'good', 'fair' or 'poor', were used and also the categories of 'much better', 'better', 'no change' or 'worse' described by Bailey and Wadsworth (1985). The rate of initial improvement was also noted. Any additional factors which the parents or carers thought affected the degree of post-operative drooling were noted.

Complications requiring surgical intervention or outpatient attendance were recorded as were the nature of further surgical procedures required to control recurrent drooling.

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FIG. 1
Ages of patients in study group.

Results

Between 1984 and 1987, 22 children and young adults underwent submandibular duct transposition. Twenty (91 per cent) were available for follow-up, and they comprise the study group with ages which ranged from 3 years 9 months to 17 years 8 months (mean 10 years 8 months) (Fig. 1). The cause of excessive drooling was usually cerebral dysfunction due to cerebral palsy; the other causes are given in Table I.

The mean follow-up time was 3 years and 7 months, with a range of 2 years 1 month to 5 years 4 months (Fig. 2).

The results of surgery immediately post-operatively and at the present time, assessed according to the criteria described by the two sets of authors, are shown in Table II. It was only possible to assess 17 of the patients using Crysdale's criteria from the information obtained. Even then, a 'new' category of 'good to fair' had to be introduced. All patients could be accommodated in the Bailey and Wadsworth classification (1985).

Using either set of criteria, however, all patients improved initially and only three patients moved to a lower category over the follow-up period. These were the same three using each set of criteria. Thus, 85 per cent of the study group experienced a maintained improvement.

A girl of 4 years 8 months with a congenital motor neuron problem deteriorated from 'much better' to 'no change' over the first 16 months of follow-up. Twenty one months after the first procedure she underwent bilateral tympanic neurectomies and unilateral chorda tympani sectioning, as a result of which, 2 years and 10 months after the original surgery, she is 'better'.

A boy of 12 years and 1 month with spastic quadriplegia showed marked improvement immediately after the operation but two months post-operatively was back to his pre-operative condition. He underwent bilateral tympanic neurectomies and chorda tympani sectioning 15 months after the initial operation. The initial improvement following this procedure has not been maintained and now, 5 years and 1 month after the first operation he is in his initial pre-operative condition.

The third patient is a young man who underwent his initial operation at the age of 14 years and 10 months. No definitive neurological diagnosis had been made at that time, but he has subsequently been found to have dystrophia myotonica. Although immediately 'much better' his drooling has deteriorated over the last 2 years of a 5 year 4 month follow-up period. His problems may at least in part be accounted for by a jaw deformity for which he is awaiting corrective surgery.

This last patient was one of five who experienced complications of surgery. A retention cyst developed in the floor of his mouth requiring marsupialization 14 months after the original surgery. One other patient developed a cyst in the left tonsillar region 14 months post-operatively which required surgical removal. Two further patients developed small retention cysts in the floor of the mouth, at three months and eight months post-operatively, but these resolved spontaneously. The fifth patient developed transient submandibular swelling for less than six months. Thus 20 per cent of the patients in the study group developed complications of their duct transposition, 10 per cent requiring surgical intervention.

In several instances parents or carers made comments that drooling was worse when their child had an upper respiratory tract infection or was not concentrating properly.

TABLE I

Diagnosis	No. of patients
Cerebral palsy	9
Mental retardation—cause unknown	2
—chromosomal abnormality	2
Spastic quadriplegia	3
Lesch-Nyhan syndrome	1
Congenital motor neurone problem	1
Hypotonia	1

Discussion

Several studies have analysed the results of submandibular duct transposition for drooling in large numbers of patients (Cotton and Richardson, 1981; Bailey and Wadsworth, 1985; Crysdale and White, 1989).

Crysdale and White (1989) reviewed two groups of patients drawn from his total series of 194 patients, of whom 145 were aged 17 years or less. The first group contained 107 patients, assessed qualitatively, who were followed up for at least one year. The outcome at last follow-up was 'fair', 'good' or 'excellent' in 95 patients (89 per cent). The second group of 115 patients was assessed quantitatively and followed up for a minimum of six months (average 19.1 months). Only four patients appear to have failed to improve their 'score' after surgery; 97 per cent of patients therefore benefited from surgery. Further surgery for the management of persistent ranulas was required in 15 of 194 patients (8 per cent). All such ranulas were evident within six months of

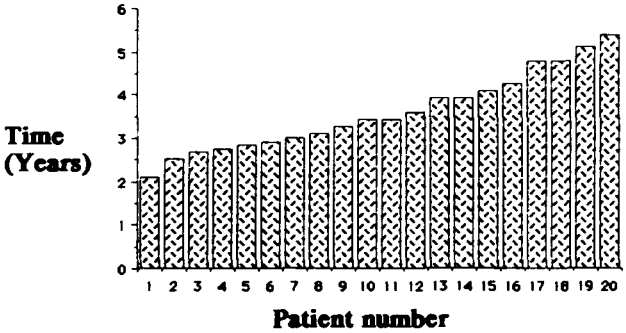

FIG. 2
Follow-up periods for patients in study group.

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TABLE II

	Immediately post-operatively	Now
Crysdale criteria		
Excellent	9	10
Good	5	4
(Good to Fair)	1	2
Fair	1	0
Poor	1	1
Total	17	17
Bailey and Wadsworth criteria		
Much better	17	14
Better	3	4
No change	0	2
Worse	0	0
Total	20	20

surgery. In another paper, Crysdale *et al.* (1988) point out that these 'ranulas' are usually extravasation pseudocysts which arise following disruption of sublingual gland elements. This complication changed the author's practice and he now removes the sublingual glands at the time of duct transposition. Lateral cervical cyst formation necessitating submandibular gland excision was required in four patients (2 per cent) (Crysdale and White, 1989).

Bailey and Wadsworth (1985) followed up 25 children (aged 4.5–16 years) following submandibular duct transposition. The follow-up period was from 3 to 25 months. An improvement was noted in 88 per cent of patients. Two patients (8 per cent) developed 'ranulas' requiring surgical treatment. A further three patients developed other complications, giving an overall complication rate of 20 per cent. Sialadenitis requiring antibiotic treatment occurred in one patient, self-limiting swelling of a submandibular gland occurred in a second whilst the third developed a 'ranula' which resolved spontaneously.

Cotton and Richardson (1981) transposed the submandibular ducts of 25 patients between the ages of 5 and 14 years before early 1981 and followed them up for periods ranging from one to five years. 'Adequate improvement' was obtained in all but one patient (96 per cent). A floor of mouth infection occurred in one patient, submandibular swelling in a second and ranulas formed in two others (8 per cent). Only one ranula required surgical treatment. However, the same department has recently reported a series of patients who underwent surgery for drooling since 1981 (Shott *et al.*, 1989). Only six patients had submandibular transposition alone and all returned to the 'not improved' category after a few months. This apparent sudden change in the efficacy of the procedure led to an alteration in surgical technique and the authors now report their treatment of choice to be bilateral submandibular gland excision and bilateral parotid duct ligation.

Key words: Submandibular gland; Sialorrhoea

Smaller series have also been reported. Guerin (1979) followed up 18 children after duct rerouting but does not say over what period. All improved but ranulas were noted in two patients (11 per cent).

No ranulas are reported in the two series in the dental literature although both series are very small. Cranin and Bennett (1982) reported five patients (only three of whom were under 18 years of age) with follow-up periods of 2.75 to 4.5 years. All improved with no complications. Fear *et al.* (1988) reported eight patients (six less than 18 years of age) with follow-up periods of six weeks to 1.5 years. Of the six children, four were improved. No complications were reported. It will be recalled that both these groups of authors excise the sublingual glands; this may account for the absence of postoperative ranulas.

The results in the present series compare favourably with the results noted over the short-term in the series described and confirm that submandibular duct transposition for drooling in children with neurological dysfunction is a procedure with a high success rate and low morbidity.

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