The Journal of Laryngology and Otology
March 1995, Vol. **109**, pp. 206–208

The influence of bismuth subgallate and adrenaline paste upon operating time and operative blood loss in tonsillectomy

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Abstract

The aims of this study were to demonstrate the effect of bismuth subgallate and adrenaline paste application to the tonsillar fossae on operating time and peroperative blood loss during tonsillectomy. Ninety-eight patients were included in a prospective randomized trial.

Bismuth subgallate powder is mixed with 10 ml of normal saline and 0.03 ml of 1:1000 adrenaline to make a paste. This paste is used as a topical haemostatic agent during tonsillectomy. Bismuth subgallate activates Factor XII and therefore accelerates the coagulation cascade. Adrenaline causes vasoconstriction and promotes platelet aggregation. The application of bismuth subgallate and adrenaline paste to the tonsillar fossae during tonsillectomy reduces operating time by 23 per cent for Consultant staff ($p<0.05$) and 32 per cent for Junior staff ($p<0.05$). Blood loss is reduced by 21 per cent ($p>0.05$), for the average paediatric tonsillectomy.

Key words: Tonsillectomy, Haemostatic techniques

Introduction

Bismuth subgallate (BSG) and adrenaline paste is widely used in Ireland as an adjuvant to haemostasis, during tonsillectomy alone, or tonsillectomy with adenoidectomy. This substance has been used for over twenty years as a topical haemostatic agent during tonsillectomy and adenoidectomy (Maniglia *et al.*, 1989). Bismuth subgallate activates Factor XII, thereby greatly accelerating the coagulation cascade and promoting rapid haemostasis (Thorisdottir *et al.*, 1988). Bismuth subgallate and adrenaline paste is made by mixing 13 gm of bismuth subgallate powder with 10 ml of normal saline and 0.35 ml of 1:1000 adrenaline. This yields a mixture of toothpaste-like consistency which is spread generously on the swabs used to pack tonsillar fossae during tonsillectomy (Maniglia *et al.*, 1989).

The combination of bismuth subgallate and adrenaline offers advantages. Adrenaline is a powerful vasoconstrictive producing retraction of blood vessels in the tonsillar fossae and adenoidal bed. Adrenaline also promotes platelet aggregation in the formation of a blood clot. BSG application should therefore reduce both peroperative blood loss and operating time. To test this hypothesis, a prospective randomized trial was conducted to demonstrate the effect of BSG on firstly operating time, and secondly peroperative blood loss in tonsillectomy.

Patients and methods

Ninety-eight patients were entered into a prospective randomized trial. There were 51 patients in the group using bismuth subgallate and adrenaline paste and 47 patients in the control group. Bismuth subgallate and adrenaline paste was spread on the gauze swabs used to pack the tonsillar fossae of the BSG group. Plain gauze swabs were used for the same purpose in the control group. Tonsillectomy operating time was defined as the time from the initial incision in the anterior faucal pillar mucosa to the time the Boyle–Davis gag was removed. Blood loss was carefully estimated by (i) weighing the stained swabs against an equal number of unused swabs and (ii) carefully measuring the volume of blood in the suction bottle at the end of the operative procedure, only known volumes of saline passed into the suction line. The weight of the blood on the swabs was divided by the specific gravity of blood (1.055) to obtain the true volume (Shalom, 1964). On completion of the trial the results were statistically analysed. The Mann–Whitney U test of significance of difference was used to estimate probability.

Results

The average age of the control group was 13.0 ± 9.4 years (mean ± standard deviation) while that of the BSG group was 14.6 ± 10.0 years. The two groups are not significantly different ($p = 0.34$). The average body weight of the BSG group was 45.0 ± 21.0 kg and the average body weight of the control group was 40.0 ± 22.0 kg. The probability value again shows that the two groups are not significantly different ($p = 0.17$) (Table II).

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Accepted for publication: 6 December 1994.

TABLE I
DESCRIPTIVE STATISTICS

	Cohort	Number	Mean	Lower 95% confidence level	Upper 95% confidence level	Standard error of the mean	Standard deviation
Junior staff time (minutes)	BSG	34	18.8	15.9	21.6	1.4	8.2
	Control	25	27.8	23.2	32.4	2.2	10.8
Consultant staff time (minutes)	BSG	17	12.6	8.9	16.2	1.7	6.8
	Control	22	16.3	13.5	19.2	1.4	6.1
All surgeons' time (minutes)	BSG	51	16.8	14.4	19.1	1.2	8.2
	Control	47	22.6	19.4	25.8	1.6	10.6
Junior staff blood loss (ml)	BSG	34	100	78	121	10	61
	Control	25	117	75	160	21	99
Consultant staff blood loss (ml)	BSG	17	106	52	160	25	98
	Control	22	145	88	202	27	122
All surgeons' blood loss (ml)	BSG	51	102	81	122	10	72
	Control	47	130	97	163	16	108

Operating time

All surgeons. The average time for a control tonsillectomy was 22.6 ± 10.6 minutes. The average time for a BSG tonsillectomy was 16.8 ± 8.2 minutes. This 25.6 per cent reduction in operating time is clinically important and statistically significant ($p = 0.003$) (Table II).

Junior versus Consultant staff. The operating times were also analysed to see whether Junior staff or Consultant staff derived more benefit from using BSG.

For Junior staff the average time taken to complete a control tonsillectomy was 27.8 ± 10.8 minutes. The use of BSG reduced this time to 18.8 ± 8.2 minutes. This was a reduction of 32.4 per cent, and statistically significant ($p = 0.0014$).

For consultant staff the average time taken to complete a control tonsillectomy was 16.3 ± 6.1 minutes. The use of BSG reduced this time to 12.6 ± 6.8 minutes. This represents a 22.7 per cent decrease in operating time ($p = 0.0094$) (Table II).

A comparison of the above figures demonstrates that Consultant staff were significantly faster than their Junior staff whether BSG was used or not.

Total blood loss

All surgeons. The average total blood loss in the BSG group was 102 ± 72 ml. The average total blood loss in the control group was 130 ± 108 ml (Table I). The difference of 28 ml (21.6 per cent) is statistically insignificant ($p = 0.37$) (Table II).

TABLE II
COMPARATIVE STATISTICS, BSG *VERSUS* CONTROL (UNLESS OTHERWISE INDICATED)

Cohort characteristics	*p* value	Decrease percentage
Age	0.34	–
Weight	0.17	–
Operating time		
All surgeons	0.0030	25.6
Junior staff	0.0014	32.4
Consultant staff	0.0094	22.7
Consultant *versus* Junior staff (BSG)	0.0016	33.0
Consultant *versus* Junior staff (control)	0.0002	41.1
Blood loss		
All surgeons	0.37	21.6
Junior staff	0.89	15.0
Consultant staff	0.24	27.0

Consultant versus Junior staff. Total blood loss for Consultant staff was reduced by 27 per cent when using BSG. The corresponding figure for the Junior staff was 15 per cent. Again statistical significance was not reached ($p = 0.24$ and $p = 0.89$, respectively) (Table II).

Complications

Post-operative haemorrhage. Two of the control group but none of the BSG group suffered a reactionary haemorrhage. One of the control group and four of the BSG group were admitted to hospital because of secondary haemorrhage. These patients required only conservative treatment, none needed blood transfusion and none required to return to the theatre.

Discussion

Bismuth is a heavy metal, its salt with gallic acid is relatively insoluble and poorly absorbed from the gastro-intestinal tract. The effects of acute bismuth metal intoxication include gastro-intestinal disturbances, skin reactions, and discolouration of mucous membranes; a characteristic blue line may appear on the gums. There may be renal failure and liver damage. These effects do not appear to be common with insoluble salts used for limited periods (Martindale, 1989). No side or toxic effects of BSG with the specific use as a haemostatic agent have been reported in the literature.

Gallic acid is an important constituent of materials which we call tannins (tannic acid) which may be extracted from various plants (e.g. tea). These plant extracts containing tannins were traditionally used in the tanning of skins into leather. That process involves interaction with the proteins in the skins and the development of cross-linking in the protein to give a tough product having a higher tensile strength than the original skin (Finar, 1975).

Bismuth subnitrite, is familiar to ENT surgeons as it is used in the production of BIPP, (bismuth subnitrate and iodoform paraffin paste). BIPP was a common antiseptic for dressing wounds and discharging sinuses in the early part of the twentieth century. Contact dermatitis to BIPP is not uncommon (Goh and Ng, 1987). There is a risk of the nitrate being reduced to nitrite with the development of *met*-haemoglubinaemia. Maniglia *et al.* (1989) when reporting their 20-year experience of the use of bismuth

https://doi.org/10.1017/S0022215100129706 Published online by Cambridge University Press

subgallate in adenotonsillectomy did not report any side effects. The initial use of bismuth subgallate as a haemostatic agent was empirical and its mechanism of action was poorly understood until recently. As mentioned above, gallic acid promotes the development of cross-linking of proteins in the tanning of skins into leather. Thorisdottir *et al.* (1988) have concluded that bismuth subgallate is an activator of Factor XII (Hageman factor) thereby greatly accelerating the coagulation cascade.

Bismuth subgallate and adrenaline paste application to the tonsillar fossae during tonsillectomy decreases operating time by 23 per cent for Consultant staff and 32 per cent for Junior staff. This contrasts with studies by Sharp *et al.* (1991) and Milford *et al.* (1990), which failed to show any difference in operating time between operators when calcium alginate swabs (rather than plain gauze swabs) were used to enhance haemostasis.

Thornton (1963) showed that blood loss measured by colorimetric and swab weighing methods compare well. They also showed that there is a close correlation between the results obtained by colorimetric, swab weighing, patient weighing and blood volume techniques. Invariably the results of the colorimetric method are higher. They are 10–15 per cent more in adenotonsillectomy and 10–35 per cent in major neck operations. This is due in part to the necessarily large number of weighings (Shalom, 1964).

BSG application reduces peroperative blood loss by 21.6 per cent, but this is not statistically significant (Table II). This represents a reduction of 20 ml in the total blood loss during the average paediatric tonsillectomy, where the average total blood loss is approximately 100 ml (Shalom, 1964). It was felt that, the reason that application of a topical haemostatic agent does not affect peroperative blood loss significantly is because the major portion of the blood loss occurs during the initial dissection of the tonsils from their fossae, and that, as this is the time before swabs are applied to the fossae, relatively little reduction in blood loss should be observed, as is indeed the case.

Conclusion

Tonsillectomy, with or without adenoidectomy, remains a commonly performed procedure in most countries. Any reduction in operation time will save the hard pressed health services substantial amounts of scarce financial resources. This study has shown that the application of bismuth subgallate and adrenaline paste to the tonsillar fossae during tonsillectomy reduces operating time by 23 per cent for Consultant staff and 32 per cent for Junior staff. On this basis we recommend that bismuth subgallate and adrenaline paste should be used during tonsillectomy.

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