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Original article

Anatomical basis for impotence following haemorrhoid sclerotherapy

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Impotence has been reported as a rare but important complication of sclerotherapy for haemorrhoids. The relationship between the anterior wall of the rectum and the periprostatic parasympathetic nerves responsible for penile erection was studied to investigate a potential anatomical explanation for this therapeutic complication. A tissue block containing the anal canal, rectum and prostate was removed from each of six male cadaveric subjects. The dimensions of the components of the rectal wall and the distance between the rectal lumen and parasympathetic nerves in the periprostatic plexus were measured in horizontal transverse histological sections of the tissue blocks at the level of the lower prostate gland (*i.e.* the correct level for sclerosant injection). The correct site of sclerosant in the submucosa was on average 0.6 mm (SD 0.3 mm) deep to the rectal mucosal surface and only 0.7 mm (SD 0.5 mm) in thickness. The nearest parasympathetic ganglion cells were a mean of only 8.1 mm (SD 2.0 mm) deep to the rectal lumen.

The close proximity of the rectum to the periprostatic parasympathetic nerves defines an anatomical basis for impotence following sclerotherapy. This emphasises the need for all practitioners to be particularly careful when injecting in this area and for strict supervision of trainees.

Key words: Haemorrhoids – Impotence – Sclerotherapy – Complications

Impotence has been reported as a rare complication of sclerotherapy for haemorrhoids. The incidence of this side effect is unknown, but three cases have recently been reported.[1] This procedure is in common use and is often carried out by basic surgical trainees in the out-patient clinic. A US-based study found that 4.4% of the population is affected by symptomatic haemorrhoids and approximately one-third of these present for evaluation and management.[2] The technique most commonly used for the treatment of internal

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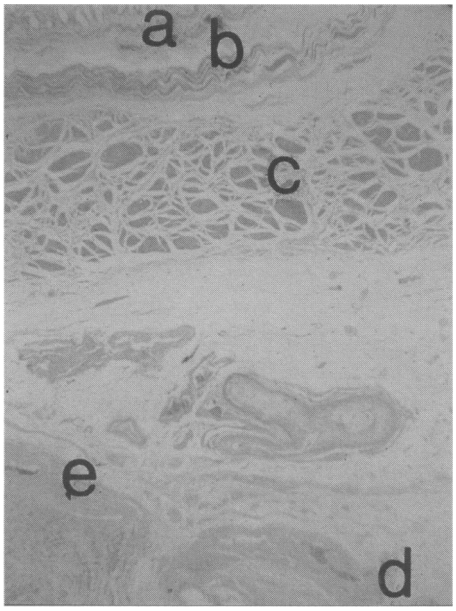

Figure 1 Large mount histological section showing the rectal mucosa at the top (**a**) with underlying submucosa (**b**), muscularis propria (**c**) and the nearest parasympathetic nerve (*i.e.* containing ganglion cell bodies) (**d**) adjacent to the posterolateral aspect of the prostate gland (**e**). Haematoxylin and eosin stain; magnification x4

haemorrhoids is the Albright method, where 3–5 ml of 5% phenol solution is injected into the submucosa just above the anorectal ring.[3] The resulting inflammatory reaction above the haemorrhoid leads to its devascularisation and reduced tendency to bleed.

The most likely mechanism for the development of impotence following haemorrhoid sclerotherapy is damage to the parasympathetic nerves innervating the corpora cavernosa of the penis. Branches of the pelvic parasympathetic plexus responsible for penile erection travel along the posterolateral aspect of the prostate to innervate the corpora cavernosa of the penis via the pudendal nerves.[4,5] Therefore, we have studied the anatomical relationship of the parasympathetic nerves in the prostatic plexus to the anterior wall of the rectum in order to determine whether incorrect placement of sclerotherapy agent, particularly during the treatment of anterior haemorrhoids, could result in damage to these parasympathetic fibres and the development of impotence.

Materials and methods

Six male cadaveric subjects were studied. The average was age 84 years and the cause of death was bronchopneumonia, left ventricular cardiac failure, pulmonary embolism or gastrointestinal haemorrhage.

A tissue block containing the anal canal, rectum and prostate was removed from each subject. After formalin fixation, the blocks underwent horizontal sectioning at the level of the lower prostate gland to obtain complete horizontal transverse sections including the anterior rectal wall and the prostate gland at the level of haemorrhoid sclerotherapy injection. Five one-micron thick histological sections were cut from each block and stained with haematoxylin and eosin. These sections were examined for parasympathetic nerves as confirmed by the presence of ganglion cell bodies within the nerve fibres. Sections containing the appropriate anatomical landmarks and of sufficient technical quality were chosen for further study.

The thickness of the various layers of the rectal wall (mucosa, submucosa and muscularis propria) and their relationship to the prostate gland and adjacent parasympathetic nerves, were assessed using x25 magnification and a Vernier scale incorporated into the microscope stage (Fig. 1). Parasympathetic nerves were positively identified as those containing ganglion cells (Fig. 2). Where technically possible, the rectal wall thickness was measured in three positions across each section (relating to 11, 12 and 1 o'clock) while the distances to the prostate gland and adjacent nerves were measured in two positions (relating to 11 and 1 o'clock). The mean and standard deviation was calculated for each measurement.

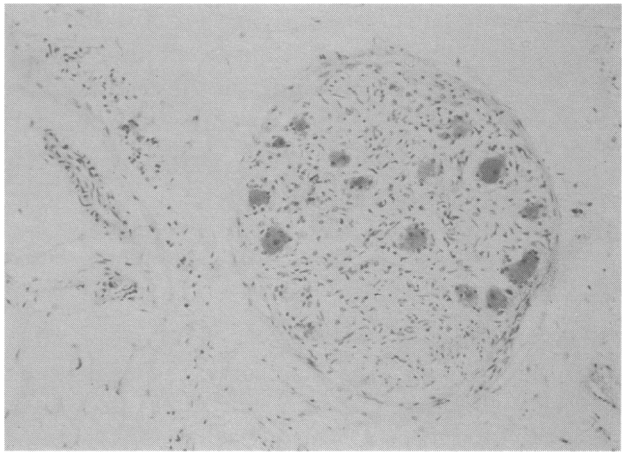

Figure 2 Detail of large mount histological section showing a parasympathetic nerve fibre at the posterolateral aspect of the prostate gland as identified by the presence of ganglion cell bodies. Haematoxylin and eosin stain; magnification x40

Table 1 Results showing the mean thicknesses of the various layers of the rectal wall together with the mean distances from the mucosal surface and submucosa of the rectum to the nearest parasympathetic ganglion cells and the prostate gland

	Mean thickness/ distance (mm)	SD	*n*
Thickness			
Mucosa	0.6	0.3	30
Submucosa	0.7	0.5	30
Muscularis propria	2.2	1.6	30
Rectal wall	3.5	1.8	30
Distances			
Lumen to nearest GC	8.1	2.0	10
Lumen to prostate	8.6	3.7	29
Submucosa to nearest GC	7.0	1.9	10

SD, standard deviation; *n*, number of measurements; GC, ganglion cell

Results

Eleven sections from the six patients studied contained anterior rectal wall and adjacent prostate gland and were of sufficient technical quality to enable accurate measurement; therefore, all six patients contributed to the results. The results are summarised in Table 1. The mean thickness of the mucosa, submucosa and muscularis propria was 0.6 mm, 0.7 mm and 2.2 mm, respectively, while the mean total thickness of the rectal wall (*i.e.* from the lumenal mucosal surface to the outer aspect of the muscularis propria) was 3.5 mm. The mean distance from the lumenal surface of the mucosa and the deep submucosa to the nearest positively identifiable parasympathetic nerve fibres (*i.e.* the nearest nerve fibres containing ganglion cells) was 8.1 mm and 7.0 mm, respectively.

Discussion

The results from this study demonstrate the close proximity of the rectum to the autonomic nerves within the prostatic plexus responsible for penile erection. This suggests an anatomical basis for impotence after sclerotherapy, since injection of sclerosing agent slightly too deeply could result in infiltration of the tissue plane containing these parasympathetic nerve fibres.

We found that the submucosa, which is the anatomical target for sclerosing agent, was about 0.6 mm from the mucosal surface of the rectum and averaged only 0.7 mm in thickness. Haemorrhoids were not present in any of the cases studied and it is likely that congested haemorrhoidal veins present within the submucosa of the rectum *in vivo* may increase the thickness of this component of the rectal wall significantly. However, the correct site of sclerotherapy injection lies just superior to the haemorrhoids in the uppermost anal canal/rectum and, therefore, the thickness of the submucosa at this site *in vivo* may not be significantly greater than that measured in this study.

The muscularis propria of the rectum averaged only 2.2 mm in thickness and, therefore, advancing the sclerotherapy needle slightly deep to the submucosa is likely to result in sclerosing agent entering the loose connective tissue plane between the anterior rectal wall and the prostate gland. From this position, the sclerotherapy agent could infiltrate the posterolateral aspect of the prostate gland where the parasympathetic nerves are situated, resulting in nerve damage. Furthermore, the average distance between the correct site for sclerosant injection (*i.e.* the rectal submucosa) and direct infiltration of the parasympathetic nerves was only 7 mm.

The close proximity of the rectal wall to the periprostatic parasympathetic nerves that we have demonstrated would suggest that impotence could occur more commonly after sclerotherapy than has been reported. This discrepancy may be due to a variety of reasons. It is possible that our cadaveric tissue sections may not accurately reflect the *in vivo* anatomical relationship between these structures. However, we have no reason to suspect that there is a significant difference in the dimensions of the rectal wall between cadaveric and living subjects. Secondly, impotence may be an under-reported complication of haemorrhoid sclerotherapy. Thirdly, if nerve damage in this location is unilateral, then sexual function is likely to be preserved.[6] Furthermore, infiltration of these nerves by sclerosant may not invariably lead to irreversible damage.

Haemorrhoid sclerotherapy may be associated with other complications, including urinary retention, haematuria, oleouria and haematospermia.[7] These symptoms may be associated with prostatic inflammation, but no data exist on the incidence of impotence in association with prostatitis following sclerotherapy. The possibility that impotence may occur due to perineal discomfort after sclerotherapy injection cannot be entirely excluded. However, in the three reported cases of impotence following sclerotherapy, local discomfort and urinary symptoms ceased after a maximum of 2–4 months, while impotence was still present at least 1 year following the procedure.[1]

Conclusions

This study emphasises the need for extreme care when injecting the anterior haemorrhoidal area in men. It is

particularly important that the operator should see the immediate swelling in the submucosa that is characteristic of a correctly placed injection. This study has implications for surgeons' training. It may be appropriate for surgical trainees not to inject anteriorly in men until they have gained significant experience in this procedure by injecting haemorrhoids in other positions within the anorectum.

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