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The Three-Dimensional Anatomy of the Anal Sphincter Complex and its Relevance to Low Rectal and Anal Pathology

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Excellent anatomical knowledge of the anal sphincter complex (ASC) is essential for the treatment and understanding of low rectal and anal pathology. Some of the current descriptions of the ASC are contradictory. In this study, the three-dimensional (3D) anatomy of the ASC is described with relevance to low rectal and anal surgical pathology.

Six human adult cadaveric specimens (three males, three females) were obtained from the Leeds GIFT Research Tissue Programme. Paraffin embedded mega-blocks containing the ASC were serially sectioned at 250 µm intervals. Sections were stained with haematoxylin & eosin, Masson's trichrome and Millers' elastin, from which 3D reconstructions were developed.

The ASC is a complex structure, varying between individuals in the size and distribution of its layers with intermingling of fibres and inconsistency of the longitudinal smooth muscle affecting the creation of the surgical intersphincteric plane. Longitudinal fibres penetrate the internal and external anal sphincter to anchor in the submucosa and ischiorectal fossa. Striated muscle fibres from the external sphincter were identified in the submucosa in four of six specimens.

The ASC is highly complex due to the degree of variation in its structure and intermingling of smooth and striated muscle fibres and their penetration of major structures. This creates potential tissue planes for the spread of infection, fistula extension and tumour spread. The complex anatomy of the ASC also impacts on the staging of low rectal cancers in this region, which requires further investigation.