

Supplementary Material

Supplementary ultrasonography methods

Ultrasound equipment and patient preparation

All ultrasonographic examinations were performed using the RS85 Prestige ultrasound system (Samsung, Korea). Patients were instructed to empty the bladder and bowels prior to examination. No special bowel preparation was required. Examinations were conducted by experienced sonographers with formal training in anorectal ultrasonography. Given the acute and painful nature of perianal inflammatory disease, special attention was paid to patient comfort during examination. Gentle probe handling, sufficient coupling gel, and avoidance of direct compression over the most tender perianal areas were emphasized throughout the procedure. Examinations were interrupted or adjusted immediately if significant discomfort was reported by the patient.

2D high-frequency transperineal ultrasonography

For two dimensional (2D) transperineal ultrasonography, patients were placed in the left lateral decubitus position with knees flexed to fully expose the perianal region. A high-frequency linear array probe (5-12 MHz) was covered with a disposable plastic glove and applied with sufficient coupling gel. This non-invasive transperineal approach was selected as the first-line examination method to minimize pain and avoid intraluminal probe insertion during the acute inflammatory phase.

Systematic multi-sectional scanning was performed with the most prominent lesion used as the scanning center. Transverse and longitudinal scans were obtained to evaluate

perianal soft tissues. The following parameters were recorded in detail. (1) Abscess characteristics, including anatomical location (annotated using the 12-o'clock clock method); (2) Size (measured in three orthogonal dimensions), shape, boundary, and internal echogenicity; (3) Relationship between the abscess cavity and the anal sphincter complex, with abscess type classified according to the Parks classification system; (4) Fistula-related findings, including hypoechoic fistula-like tracts connected to the abscess cavity, their number, direction, continuity, and the estimated location of the internal opening.

Combined 2D high-frequency and 3D end-fire ultrasonography

In the observation group, combined transperineal ultrasonography was performed. Initial 2D high-frequency transperineal scanning was conducted using the same protocol as described above, with all relevant findings documented. Subsequently, patients were repositioned into the lithotomy position. A convex end-fire intraluminal probe (3-10 MHz), covered with a disposable condom and applied with coupling gel, was introduced through the perineum (or through the posterior vaginal fornix in female patients) to minimize discomfort and avoid direct contact with the inflamed anal region. When additional intraluminal visualization was considered necessary, in female patients, insertion through the posterior vaginal fornix was used when appropriate to avoid direct contact with the acutely inflamed anal canal and improve tolerance. This transvaginal approach has been reported as a feasible and well-tolerated alternative for evaluating anorectal and perianal pathology when transanal insertion is contraindicated or poorly tolerated.¹

Scanning was initiated in two-dimensional mode. On the transverse plane, the circular configuration of the internal and external anal sphincters was visualized to assess their continuity and echogenicity. On the longitudinal plane, the long axis of the anal canal and distal rectum was displayed to facilitate identification of fistulous tracts and potential internal openings. Following 2D assessment, the three-dimensional volumetric imaging mode was activated. Volumetric datasets encompassing the entire lesion region were acquired. Using the multi-planar reconstruction function, images were analyzed on three mutually perpendicular planes, allowing comprehensive visualization of the abscess cavity, fistula tracts, and their spatial relationship with the anal sphincter complex and levator ani muscle. Based on integrated 2D and three dimensional findings, the predicted location of the internal opening and abscess type were determined and recorded for subsequent comparison with intraoperative findings.

Data recording and storage

All ultrasonographic findings were recorded in a standardized format. Images and volumetric datasets were stored digitally for offline review and analysis. Ultrasonographic results were documented independently and were not disclosed to the operating surgeons prior to surgery.

Reference

1. Mallouhi A, Bonatti H, Peer S, Luggner P, Conrad F, Bodner G. Detection and characterization of perianal inflammatory disease: accuracy of transperineal combined gray scale and color Doppler sonography. *J Ultrasound Med.* 2004;23(1):19-27. [[Crossref](#)]