Ultrasonographic Imaging Can Predict Failure After Meniscus Allograft Transplantation

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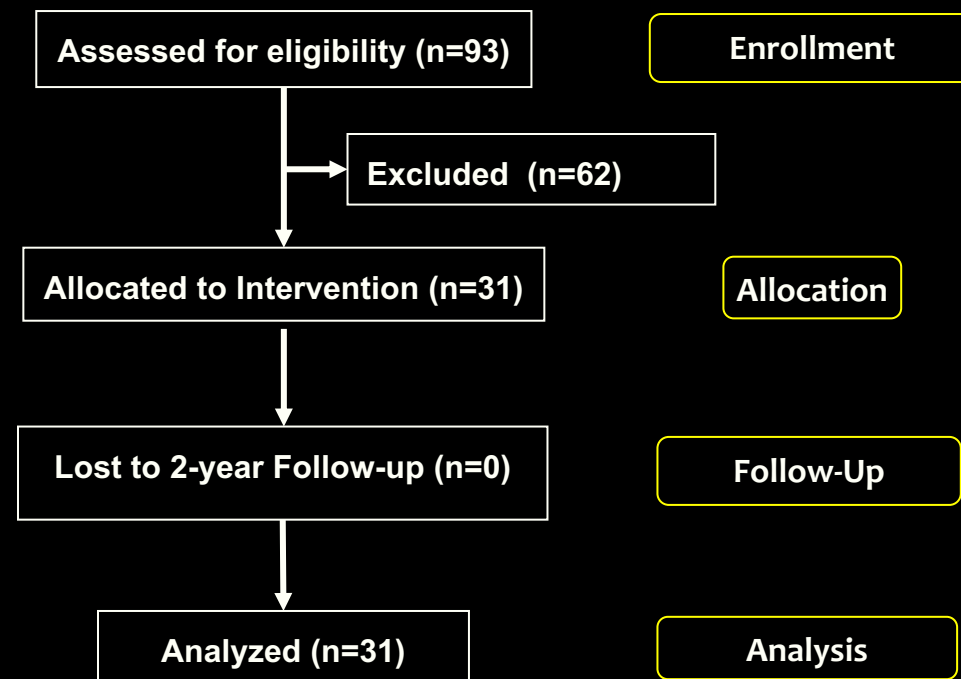
Purpose

This prospective study assessed the capabilities for serial ultrasonographic imaging during the first year after surgery to predict short-term failure in patients undergoing meniscus allograft transplantation (MAT)
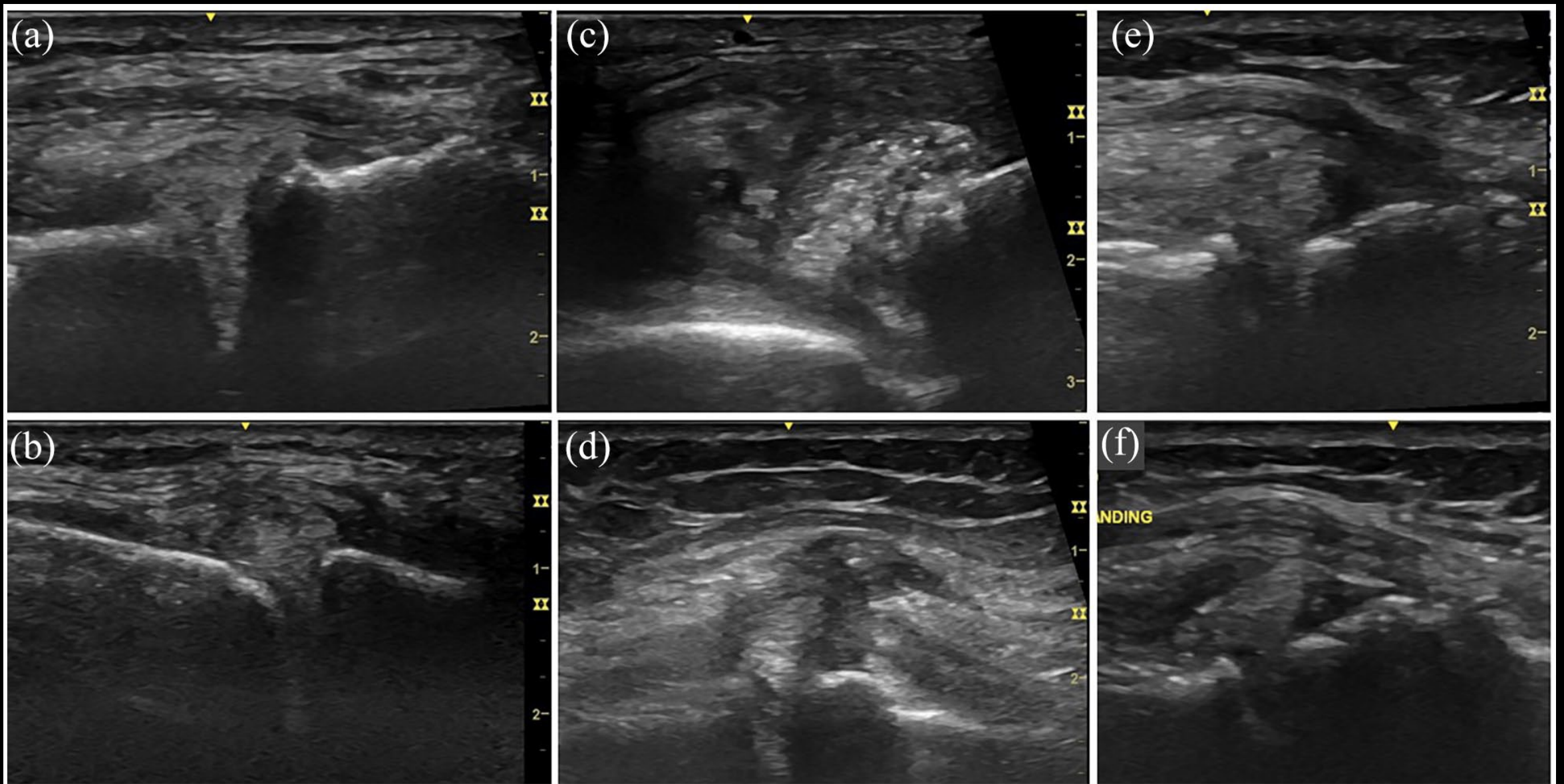
Background

- Treatment monitoring after meniscus allograft transplantation (MAT) is challenging such that complications are often diagnosed when they have already progressed to failure.

- Ultrasonographic imaging has been proposed as a modality that may allow for readily-available cost-effective treatment monitoring after MAT, but has yet to be clinically validated for this purpose.

Methods

- With IRB approval and informed consent, patients who had undergone medial or lateral MAT were prospectively evaluated by MSK ultrasonographer blinded to treatment type and time point
  - 2 weeks, 6 weeks, 6 months and 1 year after transplantation.
  - Evaluated for abnormalities in echogenicity, shape, associated effusion, extrusion, and extrusion with weightbearing.

- Associations of ultrasonographic characteristics at each time point with subsequent MAT failure were analyzed for statistical significance.

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Assessed for eligibility (n=93)	**Enrollment**
Excluded (n=62)	
Allocated to Intervention (n=31)	**Allocation**
Lost to 2-year Follow-up (n=0)	**Follow-Up**
Analyzed (n=31)	**Analysis**

Representative ultrasonographic (US) images from patients in this study at 6 months after transplantation showing. (a) Successful lateral MAT with no US abnormalities during weightbearing. (b) Successful medial MAT with no US abnormalities during weightbearing. (c) Subsequently failed lateral MAT showing abnormal echogenicity, shape, and displacement (extrusion) during weightbearing. (d) Subsequently failed medial MAT showing abnormal echogenicity, localized effusion, and displacement (extrusion) during weightbearing. (e, f) Subsequently failed medial MAT showing non-weightbearing extrusion (e) and increased extrusion with weightbearing (f).

Results

- 31 patients, mean follow-up = 32 ± 16 months

- MAT failure occurred in 6 patients (19.4%) at a median time point of 20 (range, 14-28) months with 4 (12.9%) converted to TKA

- MAT shape was maintained, echogenicity varied based on time point and patient, and localized effusion persisted through 6 weeks and progressively resolved in the majority of successful cases by one year post-MAT

- Ultrasonographic imaging was effective for assessing MAT extrusion and imaging with weightbearing (WB) demonstrated dynamic changes in MAT extrusion.

- Risk factors for **Failure** :
  - 6 months
    - Abnormal echogenicity (p=0.038; OR=11.5)
    - Localized effusion (p=0.022; OR=12.9)
    - Extrusion with WB (p=0.043; OR=8)
  - 1 year
    - Localized effusion (p=0.014; OR=14.7)
    - Extrusion with WB (p=0.014; OR=14.7)
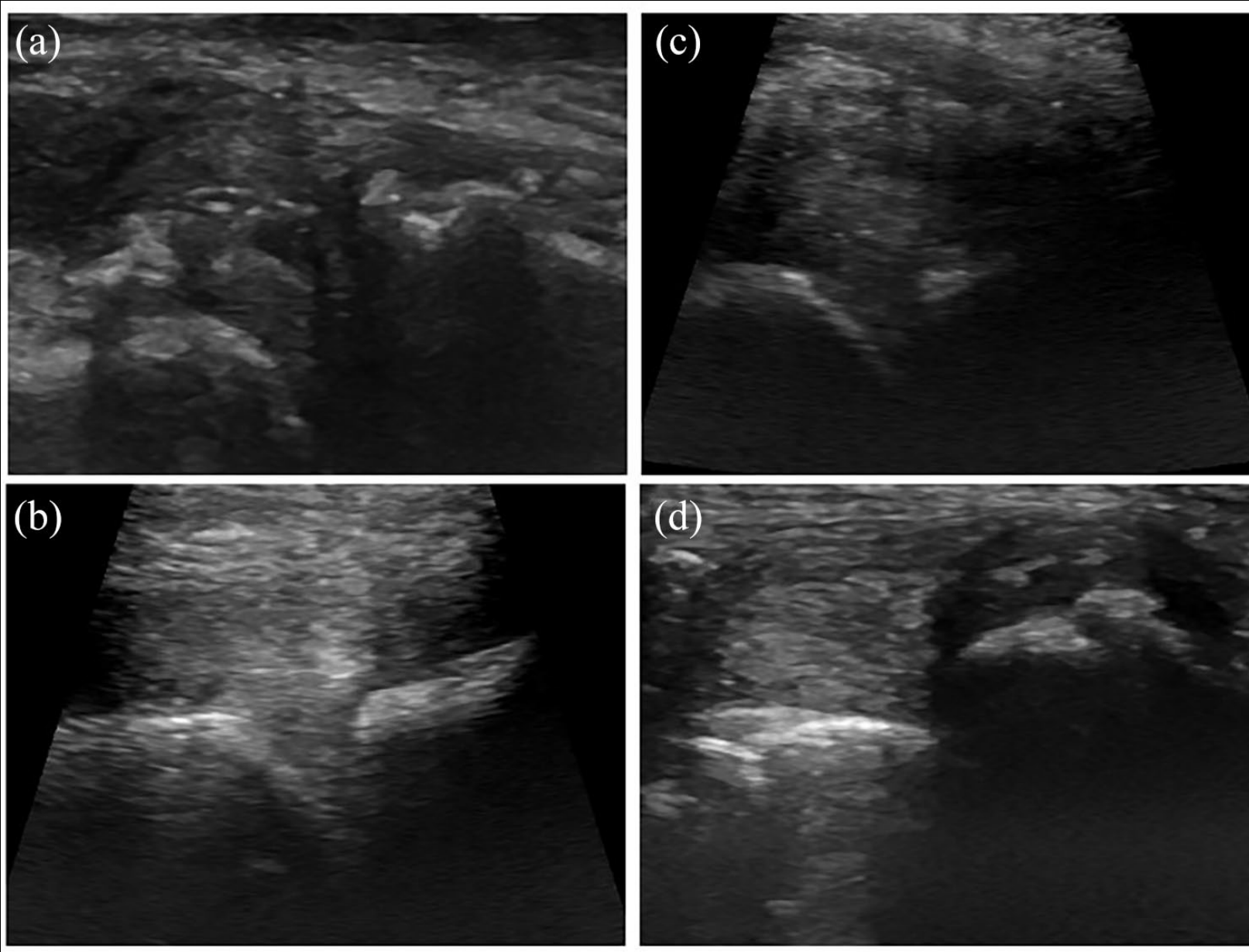
Serial US images at (a) 2 weeks, (b) 6 weeks, (c) 6 months and (d) 1 year showing progression of abnormal echogenicity, shape and displacement (extrusion) for a patient in this study who subsequently failed medial MAT 16 months after transplantation.

Conclusions

- Ultrasonographic assessments of meniscus allografts at 6 months after transplantation can effectively determine risk for short-term failure.

- Abnormal meniscus echogenicity, persistent localized effusion, and extrusion with weightbearing were associated with 8 to 15 times higher odds for failure at a median of 20 months after meniscus allograft transplantation.

- Identifying high risk for failure at this early postoperative time point may allow for implementation of management strategies to mitigate treatment failure.