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The Human Algorithm: Designing Knee Surgery through Robotics, Motion and Biology

A future-facing framework for knee surgery in which robotic precision is guided by human judgement, motion analysis, MRI biomarkers and regenerative design principles.

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THEMES	Robotic surgery · Motion biomarkers · Quantitative MRI · Regenerative orthopaedics

Scientific focus

The presentation reframes the surgeon as a ‘human algorithm’: the person responsible for interpreting and connecting mechanical, functional, imaging and biological information. Robotics may improve technical consistency, but the lecture argues that surgical value still depends on selecting an appropriate intervention and applying precision in the context of the individual patient.

Why it matters

Motion is considered as a functional biomarker that may reveal compensations and asymmetries beyond static imaging. MRI biomarkers are positioned as tissue-level signals that can inform prognosis and surgical choice when interpreted alongside function. Regenerative design extends the decision beyond mechanical correction to include joint preservation, inflammatory burden and long-term cartilage health. The proposed pathway connects prehabilitation, data-informed operative planning and biologically informed recovery.