Virtual Surgical Planning and 3D Printing in pediatric surgery for improved outcomes – A point of care facility perspective

Dr. Jayanthi Parthasarathy B.D.S., M.S., PhD,

Department of Radiology, Nationwide Children's Hospital, Columbus Ohio. USA

3D Biomodeling, virtual surgical planning and printing of patient specific models at the point of care is becoming a reality in today's context as more hospitals adopt the technology. Mostly the initiative is an extension of radiological services provided for enhanced visualization for improved, diagnosis and surgical planning and outcomes. Multimodal imaging with CT and MR is used as standard of care for better understanding of the pathology. Computer-based 3D models are generated either from CT or MR or by combining the 2 image data sets to derive the best results. The models help the surgeon understand the complex anatomy and the spatial relationship of the structures unique to each case and aim to closely simulate the surgical perspective on a 1:1 scale. Models based on patient-specific anatomy are used for surgical planning both in and out of the operating room. Patient specific, guides so derived, form the pathway to transfer the virtual surgical plan to the operatory, and creating implantable devices. Ushering in of virtual reality and augmented reality is creating a new way for presurgical planning. These processes and devices are adding value in clinical evaluation, pre-operative planning, patient and trainee education, and simulation is increasing in the past decade. Surgical specialties, cardiovascular, plastic and reconstructive, head and neck, orthopedic, neurological, urological, and oncological surgical cases effectively use the technology. Indirect applications include, patients and family education, training of clinicians and students, and developing tissue-specific phantoms, and device testing. However the process is not simple and involves several steps, image acquisition and segmentation, modeling, printing and post processing to create a very precise patient's replica. This presentation will review innovative 3D Biomodeling, virtual surgical planning, printing processes and applications in pediatric surgery with multimodality imaging and best practices for validation and improved outcomes in a hospital setting.

3D Printed Patient Specific Models – Workflow

