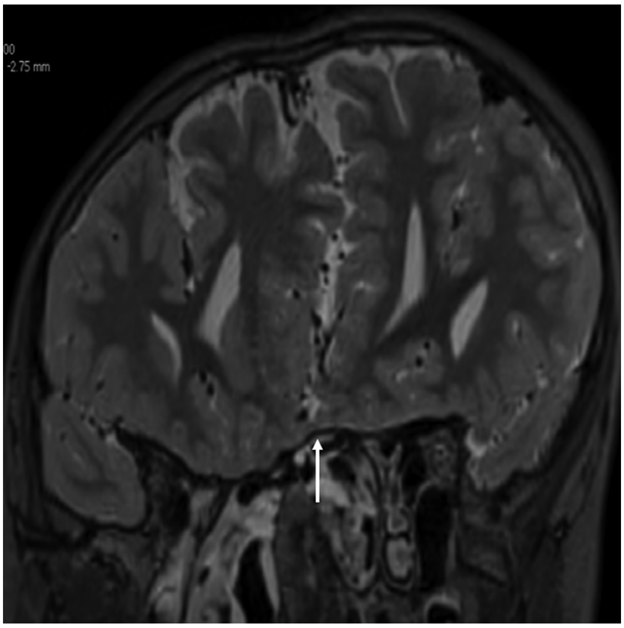
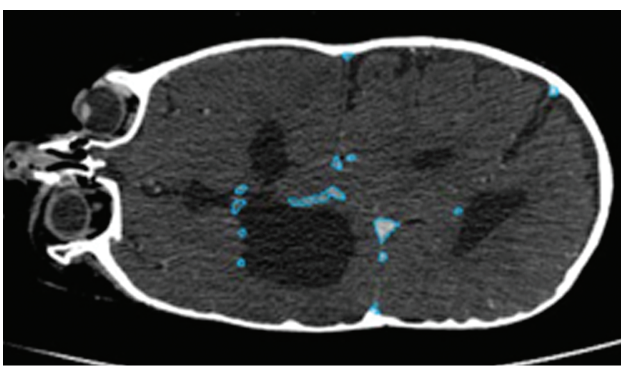
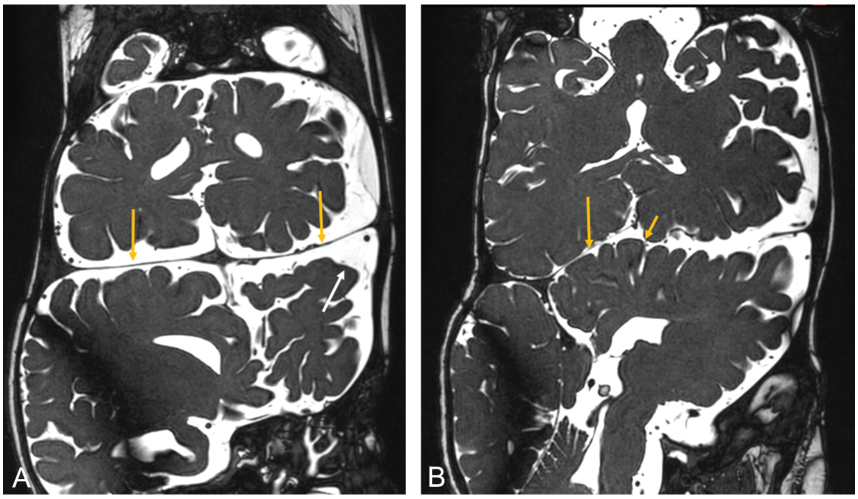


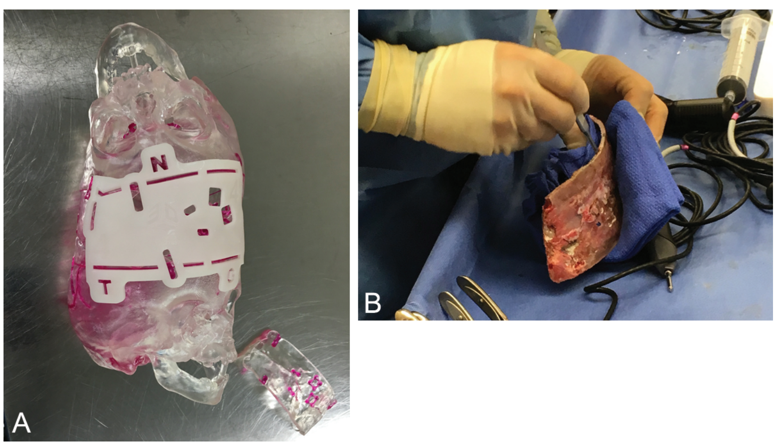
ON-LINE FIG 1. Coronal T2-weighted image from a different TA CPT. Although brain parenchyma appears separate dorsally, in cases in which there is no clear dura between cerebral hemispheres and interdigitating gyri, bridging neural tissue is often found in the operating room. More conspicuous bridging parenchyma is seen ventrally (*arrow*).



ON-LINE FIG 2. Thin-section, axial, raw data, venous structures manually segmented.



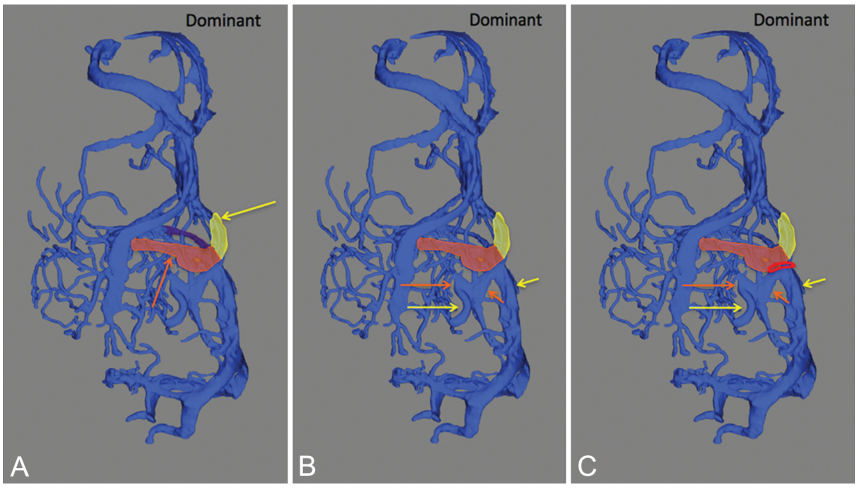
ON-LINE FIG 3. A heavily T2-weighted coronal thin-section image (*A*) depicts clear separation of brain parenchyma (*white arrow*) by a layer of dura (*yellow arrows*). In contrast (*B*), a more dorsal coronal image in the same patient shows a section separated by dura (*long yellow arrow*) and a contralateral section not separated by dura (*short yellow arrow*), suspicious for fusion on presurgical planning despite an apparent thin sliver of CSF signal.



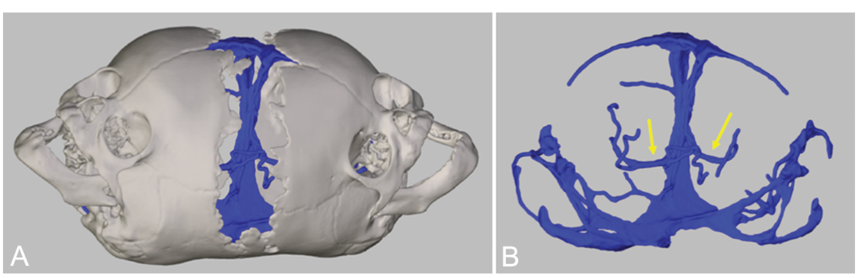
ON-LINE FIG 4. Acrylic model of the CPT generated from CTV data with an additional acrylic, white overlaid template (*A*) created for resecting shared calvaria to create a split-thickness graft (*B*) to cover larger calvaria defects.

ON-LINE FIG 5. Ceramic model generated from CT data before the fourth and final stage of separation depicting veins (blue) and silastic sheets (yellow), placed at each earlier stage of surgery to prevent interval fusion of brain, and with areas of presumed fused brain (green) to help guide surgery. In reality, there is always more fused brain at the time of surgery than originally presumed.

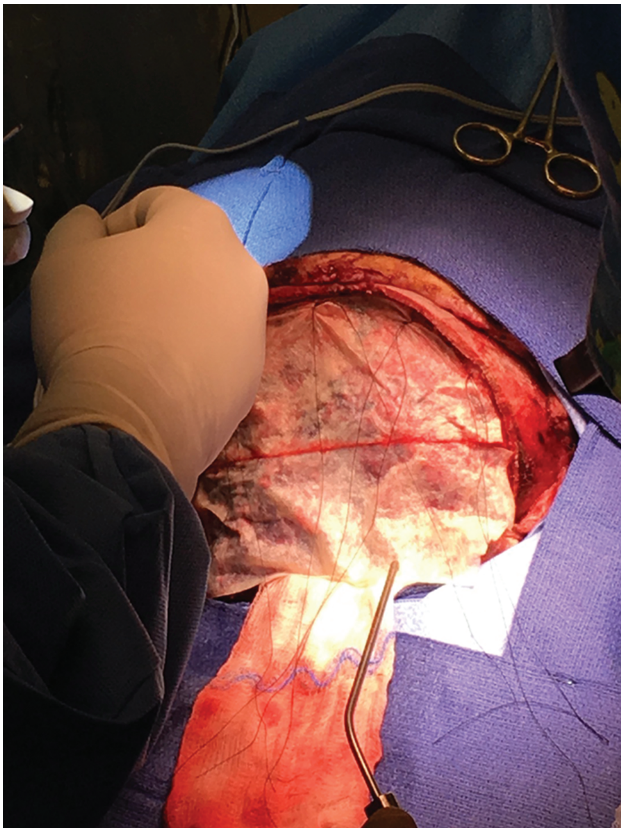
ON-LINE FIG 6. Intraoperative picture showing a 3D acrylic model created to illustrate venous anatomy next to the twins, used as direct reference throughout the surgical procedure.



ON-LINE FIG 7. Digital 3D venous phase images demonstrate structures that will be contributed to the dominant twin in the fourth and final phase of surgical separation (*A*): a shared, peripheral, and midline venous portion of circumferential sinus, connecting each twin's sagittal sinuses posteriorly (yellow). The nondominant twin's sagittal sinus (orange) will be contributed to the dominant twin; a smaller segment of the circumferential vein (purple), along the midline, will be donated to the dominant twin as well. All 3 structures join above the confluence of the straight sinus with sagittal sinus in the nondominant twin. Orientation to the critical anatomy in the nondominant twin (*B*): sagittal sinus (*short yellow arrow*), internal cerebral veins (*long yellow arrow*), vein of Galen (*long orange arrow*), straight sinus, inserting high on sagittal sinus, in essence a high confluence of sinuses (*short orange arrow*). *C*, The area considered for endovascular embolization (*red outline*), if optimally and constructively performed, would preserve the nondominant twin's central circulation and allow division of the dominant twin from the nondominant twin's sagittal sinus. This approach had a very low chance of success due to the limited area allowed for landing embolization material. Embolic material would have to remain confined to a subcentimeter section to occlude only this venous segment (red), not migrate, and allow separation in the operating room by cutting through its center. Endovascular embolization of this area was deferred.



ON-LINE FIG 8. TV CPT with anatomy not favoring separation. The twins were conjoined in a tilted "stove-pipe" configuration at the top of the head with very little rotation (*A*). Craniectomies were performed at the equatorial margin at an outside institution. The rotation of the twins relative to each other is almost symmetric. The bone is included for reference. After the bone is digitally removed, we see only the veins (*B*). Each twin's deep drainage, the straight sinus (*yellow arrows*), courses to the sagittal portion of the circumferential sinus. Separation of these twins was not possible. The sacrifice of deep venous anatomy of either twin would certainly put the survival of both twins at risk.



ON-LINE FIG 9. Porcine dural graft applied to an open cranial defect.

On-line Table: Summary of CPT classification

Authors	Year	Brief Description
O'Connell[29]	1976	Total CPT: extensive shared surface area with widely connected cranial cavities Partial CPT: limited, superficial surface area affected Subdivided on the basis of the degree of rotation of one head in relation to the other, with different deformities of the brain and abnormal circulation for each: Type I: face the same direction Type II: face opposite sides Type III: intermediate angle of rotation
Winston[45]	1987	Partial-to-complete A–D grading system, which emphasized the deepest shared structures depicted by progressive dural and arachnoidal loss, with inseparable cerebral tissue Type A: shared scalp with each brain enclosed in an independent dural envelope, though calvaria may be fused Type B: shared dura and intact plane of dura separate the brain Type C: shared leptomeninges with an incomplete dural separation and discrete brains Type D: continuous brains SDVS categorized as types C and D Although it was noted that axial rotation and angulation were important, these were not included in the system
Gaist et al[28]	1987	Expanded the O'Connell classification into 3 types: Partial: small or intermediate area of conjunction, mainly in the frontal region, with minor cerebral deformities and circulatory connections Transitional: intermediate or ample contact surface and minor cerebral deformities Venous cross-circulation may be negligible (subtype A) or marked (subtype B) Total: usually vertical, having an extremely wide area of conjunction involving the cranial vault in its entirety, with true continuity between the 2 skulls; cerebral deformities are constant and severe, as are vascular anomalies, with a common venous pool
Stone and Goodrich[7]	2006	Partial CPT: lacking substantial SDVS Total CPT: share substantial dural venous sinuses and present with pronounced brain compression, which leads to distortion in the cranium Two main subtypes based on the long-axis angle between twins: angular and vertical (Fig 1) Vertical craniopagus calvaria are continuous and are further subdivided on the basis of intertwin axial facial rotation, similar to the O'Connell[29] classification