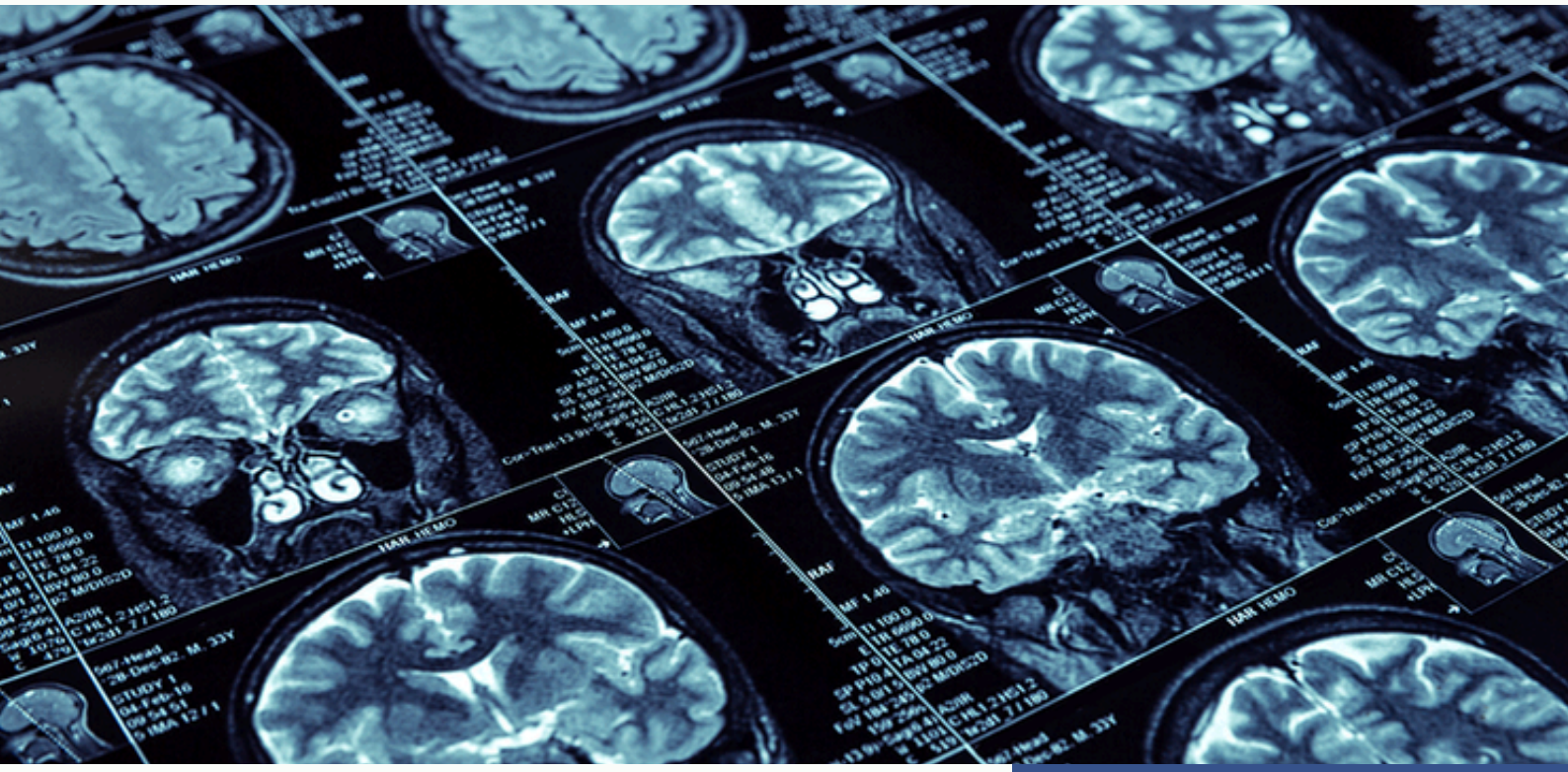
neurobulletin

Dandy Netherlands Neurosurgical Club



Case: High Thoracic Spinal Cord Injury Following a Fall

A 68-year-old male was brought to the ED after falling down a flight of stairs. His medical history included prostate carcinoma, for which he had refused complete treatment. On arrival, he was hemodynamically stable but had a GCS of 2-5-2 and complete motor and sensory loss below T3, suggesting a high thoracic spinal cord injury. CT imaging revealed bilateral frontal traumatic SAH, a right-sided subdural hematoma without midline shift, and a T3 fracture with a displaced fragment compressing the spinal cord and edema at T3-T4. Given the devastating neurological deficits and poor prognosis, a multidisciplinary team, including neurosurgery, ICU, and palliative care, decided on a palliative approach. The patient was transitioned to comfort care and passed away the following day. This case highlights the severe consequences of high thoracic spinal cord injuries and the complexity of decision-making in elderly patients with multiple traumatic injuries. While early surgical decompression may benefit select spinal cord injuries, complete spinal cord transection at a high thoracic level is often associated with a poor functional outcome. Additionally, concurrent traumatic brain injuries, even if not initially life-threatening, can further complicate recovery. In cases where meaningful neurological recovery is unattainable, early discussions regarding goals of care are essential.

IN THIS ISSUE

NEUROSURGEONS THROUGH HISTORY
--PAUL BUCY--

The field of neurosurgery has been shaped by several visionaries whose contributions continue to influence the diagnosis and treatment of neurological disorders. People often associate neurosurgery with operations involving the brain. However a crucial element neurosurgery is also spinal surgery. Dr. Paul C. Bucy stands out as a neurosurgeon whose work not only advanced the understanding of brain function but also played a pivotal role in spinal cord pathology and neurosurgical techniques. While he is often recognized for his research on the limbic system and the famed Klüver-Bucy syndrome, his contributions to spinal neurosurgery and neuroanatomy remain equally significant. His work in classifying spinal cord tumors, understanding spinal trauma, and enhancing surgical approaches has left a lasting impact on the field.

Early Life and Education

DPaul Bucy was born in 1904 in rural Hubbard, Iowa and grew up in a household with values such as decency, respect for truth, and hard work. These values were later instilled in his own work ethic and that of his associates and subordinates. Paul was accepted into Harvard College to puruse his undergraduate degree, however due to financial troubles he could not attend the university. Instead he obtained his degree from Iowa State College and later obtained his M.D. from the University of Iowa. He later completed his residency in neurosurgery at the University of Chicago under the mentorship of Dr. Percival Bailey, a leading figure in neuropathology. Dr. Bucy was running the department soon after his arrival as a result of Dr. Bailey becoming ill. Within a month, he was successfully operating a patient with a brain tumor.

Dr. Bucy also went abroad to study under Norman Dott in Edinburgh, Gordon Holmes in London, and Otfrid Foester in Germany. Furthermore he spent time in Dr. John Fulton's laboratory at Yale University. These men undoubtably had an influence on Dr. Bucy's career and helped shape his future career.

Advancements in spinal surgery

After his return from London, his work primarily focused on the pyramidal and extrapyramidal systems. His work was pivotal for the days of the burgeoning surgery for Parkinson disease. As for his work in spinal neurosurgery, his contributions were primarily in the areas of spinal cord trauma, tumor classification, and surgical techniques. At a time when spinal cord injuries were often considered untreatable, Bucy was among the neurosurgeons who sought to refine diagnostic tools and treatment strategies. He emphasized the importance of early intervention in spinal cord trauma and contributed to the growing body of knowledge on spinal cord edema and hemorrhagic necrosis, which would later inform modern spinal injury management.

One of Bucy's most notable contributions was his work with Dr.Bailey in classifying spinal cord tumors. Their classification system improved the ability of neurosurgeons to differentiate between benign and malignant tumors, thus influencing surgical decision-making. Before this classification, spinal tumors were often diagnosed too late for effective intervention. Bucy's work helped establish a framework for early identification and treatment, which remains a cornerstone of modern spinal oncology.

In addition to tumors, Bucy also conducted research on the neuropathological effects of spinal cord trauma. His studies explored how trauma at different spinal levels led to varying neurological deficits, and he was among the early proponents of decompressive surgery for spinal cord injuries. At a time when conservative management was often preferred, Bucy provided evidence that early surgical decompression could improve functional outcomes in select patients. Furthermore, Bucy was also involved in refining spinal surgical techniques, including laminectomies and decompressions. His research also contributed to the understanding of vascular injuries to the spinal cord, particularly how blood supply disruption led to progressive neurological deterioration. This knowledge influenced later developments in spinal cord injury treatment.

The Kluver-Bucy Discovery

Though much of Bucy's fame came from his work on the limbic system—where he, along with Heinrich Klüver, described the Klüver-Bucy syndrome following temporal lobe lesions. The Kluver-Bucy syndrome is a neuropsychiatric condition due to lesions affecting both temproal lobes, more specifically the hippocampus and amygdala. It presents as hyperorality, hypermetamorphosis, hypersexuality, bulimia, placidity, visual agnosia, and amnesia. It was first described by two British neurologists, however described by Klüver and Bucy, unaware of previous reports, following a bilateral temproal lobectomy in a Rhesus monkey named Aurora.

Beyond the Operating Room

Outside surgery, his extracurricular interests were broad which included reading and being a prolific writer. He even became the president of the Chicago Literary Club! He also enjoyed traveling and documented this in his book Beyond All Dreams, with his wife as a co-author. At the time of his death, Bucy was the last founding member of the Harvey Cushing Society. Today, as neurosurgeons continue to push the boundaries of spinal surgery and neuroprotection, Bucy's contributions remain a testament to the power of meticulous research and clinical innovation. His legacy endures in the operating rooms and research labs of neurosurgeons worldwide, ensuring that spinal cord patients receive the best possible care.

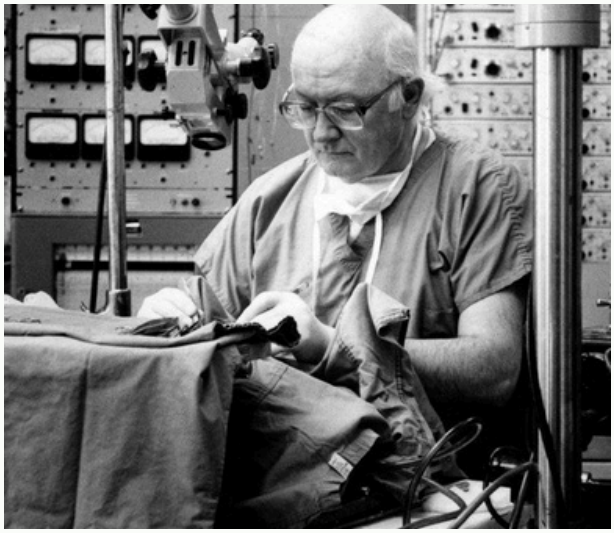
WRITTEN BY:
PAWAN RAVINDRAN

THE EVOLUTION AND TECHNICAL FEASIBILITY OF CEPHALOSOMATIC ANASTOMOSIS: FROM ANIMAL MODELS TO HUMAN PROSPECTS

Cephalosomatic anastomosis (CSA), or head transplantation, represents one of the most contentious frontiers in modern neurosurgery. Since the pioneering efforts of Vladimir Demikhov and Robert White in the mid-20th century, the concept has evolved from rudimentary vascular anastomoses in canines to theoretical human applications facilitated by advances in neuroregenerative and anastomotic techniques. More recently, Sergio Canavero and Xiaoping Ren have driven research into human CSA, leveraging breakthroughs in spinal cord fusion, ischemic neuroprotection strategies, and neuroplasticity. This column provides a comprehensive review of the historical development of CSA, its technical evolution, and the contemporary methodologies designed to surmount physiological, immunological, and ethical challenges.

Historical Foundations and Experimental Models

The earliest documented CSA attempts were performed by Demikhov in the 1950s, in which secondary heads were transplanted onto dogs through vascular anastomosis of the major arteries and veins. These models exhibited limited postoperative survival due to immunological rejection and the lack of functional spinal reconnection. In 1970, Robert White performed the first cephalic transplantation in primates, transplanting the head of a rhesus monkey onto the decapitated body of another.



The transplanted head retained cognitive and sensory function, yet the absence of corticospinal tract continuity resulted in complete motor paralysis. The short postoperative lifespan, attributed primarily to immune-mediated graft failure and systemic incompatibilities, underscored the fundamental challenges of CSA.

Technological Advances and the GEMINI Protocol

One of the primary obstacles in CSA is achieving reconnection of the severed spinal cord to restore electrophysiological continuity. Traditional spinal cord injuries lead to glial scar formation, a major impediment to axonal regeneration. Canavero introduced the GEMINI spinal cord fusion protocol, which employs fusogens such as polyethylene glycol (PEG) and chitosan-based hydrogels to facilitate immediate reconnection of severed axonal membranes. Studies in animal models suggest that these compounds can induce axoplasmic continuity and promote neurofunctional recovery when applied immediately after transection.

The GEMINI technique consists of:

1. Ultra-sharp severance of the spinal cord using a nanometer-scale diamond blade to minimize mechanical trauma and reduce secondary damage.
2. Immediate application of fusogenic agents (PEG, chitosan) to enhance membrane fusion of severed neuronal projections and prevent Wallerian degeneration.
3. Negative-pressure stabilization at the fusion site, reducing micromovements that could disrupt axoplasmic continuity and impede reconnection.
4. Neuromodulatory electrical stimulation, fostering synaptic plasticity and potentially restoring descending motor control.

Neuroprotection and the Hypothermia Protocol

A critical challenge in CSA is preventing ischemic neuronal injury during cephalic detachment and revascularization. White initially developed the hypothermia protocol to mitigate neuronal apoptosis and oxidative damage. Canavero's HEAVEN (Head Anastomosis Venture) procedure integrates profound hypothermia (12–15°C) to extend the ischemic tolerance window and reduce metabolic demands.

Key procedural steps include:

1. Selective cerebral hypothermia induction, wherein the recipient's head is perfused with cooled Ringer's lactate via extracorporeal circulation, rapidly lowering cortical metabolism.
2. Whole-body hypothermia of the donor, reducing systemic metabolic demand and prolonging organ viability.
3. Jugular-carotid cross circulation, utilizing donor circulation to maintain cerebral perfusion prior to complete vascular anastomosis.
4. Post-revascularization controlled rewarming, limiting oxidative stress associated with reperfusion injury and preventing mitochondrial dysfunction.

Obstacles and Future Perspectives

Despite the theoretical promise of GEMINI and HEAVEN, several physiological, immunological, and bioethical barriers remain:

- Spinal cord reconnection remains unproven in primates and humans. Even with successful axonal fusion, restoring functional corticospinal transmission remains speculative.

- Immune rejection and neuroinflammatory responses pose significant risks. The central nervous system presents unique immunological challenges, particularly regarding immune recognition of foreign neural tissue.
- Postoperative rehabilitation and neuromodulation protocols must be refined. Even with successful reconnection, optimizing neuroplasticity and motor function recovery remains an ongoing challenge.
- Ethical concerns persist regarding personal identity, psychological adaptation, and societal implications. The long-term psychosocial consequences of CSA remain largely unknown.

Ethical and Societal Considerations

The feasibility of human CSA raises profound ethical, philosophical, and societal questions. One central dilemma involves the allocation of medical resources: a single CSA procedure requires an entire donor body, whereas the same donor's individual organs could save multiple lives. This raises concerns about distributive justice and organ transplantation prioritization.

Additionally, CSA introduces genetic implications: since the transplanted body retains its original DNA, offspring conceived postoperatively would be genetically related to the donor rather than the recipient. This raises legal and bioethical questions regarding identity, heredity, and parental rights.

Moreover, CSA intersects with emerging research on parabiosis, the surgical linkage of two organisms to create a shared circulatory system. Studies in murine models have demonstrated that exposure to young systemic factors enhances neurogenesis, improves cognitive function, and delays cellular senescence.

This suggests that a CSA recipient with a significantly younger donor body could theoretically experience extended longevity, potentially challenging conventional paradigms of aging and human lifespan limitations.

Beyond medical feasibility, CSA necessitates a broader discussion on sociocultural and legal frameworks. Equitable access to such procedures, the psychological burden on recipients, and the ethical permissibility of life-extension surgeries must be addressed before any clinical translation of CSA occurs.

Conclusion

Cephalosomatic anastomosis remains at the intersection of speculative neurosurgery, regenerative medicine, and bioethics. Historical advancements have established the groundwork, while contemporary strategies such as the GEMINI spinal cord fusion protocol and the HEAVEN neuroprotection strategy attempt to surmount long-standing technical challenges. However, before considering human trials, future research must prioritize primate models, refine neuromodulation techniques, and address ethical concerns. The viability of CSA will ultimately depend on the successful integration of microsurgical precision, neurobiological expertise, and ethical discourse to bridge the gap between theoretical plausibility and clinical reality.

Author Declaration: As the author of this paper, I neither advocate for nor oppose the concept of cephalosomatic anastomosis (CSA). My interest lies purely in the realm of neurosurgical advancements and groundbreaking research. I am a passionate enthusiast of neurosurgery who values ethical considerations highly and acknowledges the profound implications of such experimental procedures.

WRITTEN BY:
FEDDE WEENINK

MEET THE BOARD: PAWAN RAVINDRAN

Every month, we will highlight another member of our board, so you get to know us better. This month you can read about Dandy's secretary, Pawan Ravindran.

Getting to Know Pawan

How old are you and how old do you feel?
I'm 23 years old, but after playing basketball for so long, my knees definitely make me feel like I'm pushing 50!

Which faculty are you in, and what year are you in? And what do you like most about your faculty?
I'm a final-year medical student (6th year) at Maastricht University, in the Faculty of Health, Medicine, and Life Sciences. What I love most is the multidisciplinary approach, where students from different backgrounds collaborate and offer diverse perspectives on biology.

Where are you from, and where do you currently live?
I was born in India, grew up in Almere, and now I live in Maastricht.

Neurosurgical questions

What sparked your interest in neurosurgery?
I have always been fascinated by how neurological pathologies can alter fundamental human characteristics like consciousness, behavior, and memory. My interest in neurosurgery grew when I realized that this field offers the unique opportunity to directly treat the underlying causes of such conditions, ultimately improving patients' quality of life. Even before studying medicine, I was drawn to hands-on problem-solving that required both meticulous planning and precision.

Neurosurgery combines these elements with complex surgical procedures and a field full of unanswered questions—challenges that continue to fuel my passion for this specialty.

What do you enjoy the most about being secretary of Dandy?
The best part of this role is two-fold. First, I get to be involved in planning different events. It is also really fun to be part of the team writing the monthly newsletter

What made you sign up for Dandy?
One of my aspirations is to inspire others by sharing knowledge and teaching about medicine. Given my fascination with neurosurgery, I saw Dandy Netherlands as the perfect platform to contribute to this field while engaging with like-minded individuals.

If you could share one neurosurgical fact with everyone in the Netherlands, what would it be?
Despite being the center of pain perception, the brain itself doesn't have pain receptors, so it doesn't feel pain.

INTERVIEW WITH PAWAN – CONT'D

What is your favourite brain structure and why?
My favorite brain structure changes as I learn more, but right now, I'd say the striatum. Its role in controlling movement is fascinating, but what really caught my attention is its anatomy. I didn't expect it to look like that!

What do you enjoy the most about being the secretary of Dandy?
The best part of this role is two-fold. First, I get to be involved in planning and organizing different events. But more importantly, it's really fun to be part of the team that writes the monthly newsletter.

Off the Cuff Questions

You have a long surgery coming up. Which genre of music do you listen to?
That's a tough one. If it's a challenging surgery, I'd probably prefer silence. But if I had to pick, I'd go for a mix of rap and R&B. I'd start off with some smooth R&B, switch it up with rap to get the energy going, and finish off with a mix. And you can bet Drake would be somewhere in there!

If you were a superhero, what would your power be?
I was always a fan of the Flash, so I would choose super speed.

What's your ultimate guilty pleasure when you're cramming for exams?
Sour candy! It's super underrated (and definitely unhealthy) for exam time

What's your favourite season?
Summer. Easily.

Rapid Fire Round 🔥

Sweet or Savory?
Savory.

Books or movies?
I'm most definitely a movie guy. Christopher Nolan movies really got it for me.

Cats or dogs?
Tough one, but I think I'd choose cats today. Some days I'd go for dogs, though—just caught me on a cat kind of day.

What word of phrase do you use slightly too often?
I'm guilty of saying "that's crazy" in casual conversations a bit too many times.

Excited to meet the rest of the board? Subscribe to the newsletter and tune in every month!

WORD PUZZLE

G	H	L	A	I	R	O	T	N	E	T	A	R	F	N	I	X	U	N	L	T	A	T
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ANASTOMOSIS

BURR HOLE

CEREBRUM

CIRCLE OF WILLIS

GEMINI

HEMATOMA

HOMUNCULUS

HYPOTHALAMUS

INFRATENTORIAL

MYELUM

NEURITIS OPTICA

NEUROPLASTICITY

NUCLEUS CAUDATUS

PAUL BUCY

WHITE MATTER

FUTURE EVENTS

In the next few months, we have a few activities lined up for you. Keep an eye on our socials for the latest news surrounding our lectures.

March 9th - Transplantation neurosurgery

16.00-18.00, Rotterdam (Erasmus MC, Centraal-sp-2407)

Can a spinal cord transplant cure patients with paralysis? How far are we on successful eye transplants? In a recent publication, Dr. Sergio Canavero discusses the newest development within the transplantation neurosurgery, On March 9th, he elaborates on his writing. This is a hybrid activity.

March 29th - Hololens and Augmented Reality

Time TBD, Amsterdam (Exact location TBD)

Technology is changing inside and outside the operating room. Virtual reality and artificial intelligence become a bigger part of our lives. But how can we use these new technologies in neurosurgery? PhD student Patrick O'donnell presents you with the Hololens. Using AR (augmented reality), the precision of neurosurgical procedures might improve. Hear more about it during this hybrid activity.

NEXT ISSUE

A DEEP-DIVE INTO THE HISTORY OF NEUROSURGERY

NEW BRAINTEASER

RECAP OF PAST EVENTS

FUTURE EVENTS

AND MORE!

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