JNS PEDIATRICS

Neurosurgical Forum
BROCA'S AREA

The art of the (w)rap

Adam Ammar, MD,[1] Robin Yang, MD,[2] Rachel Pruitt, MD,[1] Kurt Lehner, MD,[1] Shenandoah Robinson, MD,[1] Alan R. Cohen, MD[1]

Departments of [1]Neurosurgery and [2]Plastic and Reconstructive Surgery, The Johns Hopkins University School of Medicine, Baltimore, Maryland

The history of wound management dates back to the dawn of civilization. Trephination, likely the oldest surgical procedure for which there is archeological evidence, is known to have been practiced around the world, beginning in Africa as early as 10,000 BCE.[1] The first descriptions of wound healing and bandaging go back more than 4 millennia,[2] and the first record of head bandaging came from Egypt well before 1700 BCE.[3]

The art and science of dressing head wounds have evolved considerably over time, and the literature is replete with discussions of different techniques for wound care and the benefits and risks of bandaging. Some surgeons even recommend not bandaging any incisional scalp wounds following intracranial surgery.[4]

In this report, the authors propose a simple and inexpensive method for creating unique postoperative head turbans for children following craniotomy. We believe these dressings can facilitate wound healing in selected cases. The main purpose of our novel scalp wraps, however, is to help mitigate the apprehension of children and their families associated with pediatric intracranial neurosurgical procedures. An unexpected secondary benefit of using these wraps was a boost in morale and team building among the surgeons and nurses in the operating suite.

The authors review the history of head bandaging and demonstrate their technique for creating the novel postoperative turbans for children.

Methods

The conventional postoperative head turban is modified in the shape of a variety of caricatures. The process began when one of the authors (R.Y.) returned from training at the Children's Hospital of Philadelphia and taught us how to use fluffs and a marker to create a simplified turban with "bear ears." We advanced this technique using material readily available in the operating room (OR), including Kerlix Bandage Rolls (MeyerDC), 3M Coban Self-Adherent Wrap (Solventum), 3M Microfoam Surgical Tape (Honest Medical), and colored markers (Fig. 1). Head wraps are personalized as a variety of 3D characters including bears, dogs, lions, unicorns, monkeys, rabbits, giraffes, sharks, crabs, lobsters, dragons, and dinosaurs.

Templates for some of the characters are printed from the Internet onto standard computer paper and cut out into shapes by the OR nurses either before or during the case. The head is wrapped in Kerlix and Coban by the circulating nurse and the surgeon at the end of the case with the child still asleep under general anesthesia. The process adds only minutes to the operative time. Other members of the nursing and surgical team often participate as well. Eyes and ears are drawn on microfoam adhesive tape. Other unique features that were printed on computer paper from the Internet are applied with Tegaderm Transparent Film Dressing tape (Solventum).

We often place a companion turban on the child's stuffed animal. Written parental informed consent to publish photographs of the children wearing head bandages was obtained in every case.

Results

During the past 3 years, we have used our modified head turbans for most of the children undergoing craniotomy at our institution. In selected cases, these head wraps have helped to obliterate dead space, minimize accumulation of subcutaneous scalp fluid, and prevent digital manipulation of the wound. In every case, parents broke out in a smile, often with tears of joy, when they first set eyes on their child in the intensive care unit. It served to remind them of the close of a life-altering ordeal. Infants are too young to appreciate the unique nature of their head bandages, but in almost every case, older children liked what they saw when they looked in the mirror. The bandages also produced an unexpected wellness benefit by enhanc-

Brought to you by Johns Hopkins University | Unauthenticated | Downloaded 07/05/25 01:34 PM UTC

FIG. 1. Material in the OR used to create the designer turbans. Figure is available in color online only.

ing team building among the surgeons and OR nurses in the process of creating the product. The process has become so popular that children sometimes specify the type of turban they want in advance.

Discussion

History and Evolution of Head Bandaging

The history of bandaging wounds dates back to antiquity. Descriptions of wound management were chiseled into Sumerian cuneiform tablets from southern Mesopotamia, now south-central Iraq, dating back to 2200 BCE.[5] Treatments described spiritual incantations and the application of poultices containing wine, beer, oil, flour, milk, mud, dust, and honey.[6] Plaster dressings were made of mixtures of mud, clay, herbs, and plants.[2] Honey was also used as a topical application in Egypt and India, suggesting that its healing powers were recognized by separate cultures.[7]

References to wound dressings with alcohol are even found in the Bible: "He stooped down and gave him first aid, pouring olive oil on his wounds, disinfecting them with wine, and bandaging them to stop the bleeding. Lifting him up, he placed him on his own donkey and brought him to an inn. Then he took him from his donkey and carried him to a room for the night" (Luke 10:34).[8] In Homer's epic poem, the *Odyssey* (800 BCE), he describes dressing a leg injury incurred by Ulysses from a wild boar: "With bandage firm, Ulysses' knee they bound."[9]

The Egyptians made seminal contributions to the management of wound care, although much attention was paid to rituals including sorcery, superstition, incantations, and exorcism. Bandaging became facile for Egyptians in the process of mummification of the dead.[10] The first record of bandaging for head wounds was in Egypt (circa 1700 BCE), documented in the Edwin Smith Surgical Papyrus.[3] This was believed by some to be a copy by a scribe of a much earlier record, attributed to the most famous early Egyptian physician, Imhotep, circa 2780 BCE. Imhotep was also known as a sage, priest, astrologer, surgeon, and the architect of the pharaoh's tomb, the Step Pyramid at Sakkara.[11]

Bandages in Egypt were made with cotton and linen held together with gum.[12] Subsequently, the Georg Ebers Papyrus (circa 1550 BCE) provided more detail about cotton and linen bandages and the topical applications to the underlying wound, which included lint (vegetable fibers), grease (animal fats), and honey (which likely had antibacterial properties and reduced tissue edema because of its osmotic dehydrating effects).[3,6,9] The Egyptians also covered wounds with green copper pigment made from the mineral malachite. The green represented life, and the copper may have acted as an astringent with bactericidal properties.[7] Other historical concoctions for dressing wounds included frankincense, myrrh, milk from a mother who had given birth to a son, fly blood, and feces.[2,4] These topical applications were likely used in a manner of trial and error as an attempt to soothe pain and accelerate healing.[12]

Hippocrates of ancient Greece (circa 460–370 BCE) washed wounds with vinegar and wine and recommended keeping them dry, avoiding greasy ointments, to facilitate improved healing.[13] Although he advocated against moist wounds, he emphasized the importance of wine: "for an obstinate ulcer, sweet wine and a lot of patience."[7] Hippocrates was the first to challenge the prevailing rigidity of the medical community and argue that suppuration was not a part of normal wound healing and pus should be avoided. He covered wounds with sphendone, a cloth that resembled a woman's head band, and warned against turning bandaging into a "foolish parade of manual skill. . . . Leave aside theatrical bandages that serve no purpose; this is miserable and fit for charlatans, and often hurts the patient. Indeed the patient is seeking not ornaments, but help."[10]

Subsequently, Claudius Galen of Pergamon (circa 129–216 AD) developed extensive experience with wound healing based on his role as chief physician to the gladiators.[12] He was an advocate of the doctrine of Hippocrates with the exception that he believed pus was *bonum et labile* ("good and commendable") in the process of wound healing.[13] This misconception of laudable pus was widely held into the Middle Ages and beyond, until the 1800s, when it was dispelled by the pioneering work of Hungarian physician Ignaz Semmelweis and British surgeon Joseph Lister.

Over time, the art of head bandaging has transformed dramatically. There are colorful descriptions of head bandaging from landmark operations in the 19th century. The first successful removal of a brain tumor was performed by Zanobi Pecchioli in Siena, Italy, in 1835. The patient was a 45-year-old farmer, and Pecchioli described the tumor as a *fungo della dura madre* ("dura mater fungus"), likely a meningioma. Pecchioli dressed the wound with fine cambric linen soaked in almond oil, followed by a skull cap of boiled padded leather. The patient survived and the wound healed by secondary intention. The case was not reported by the surgeon but by the editorial board of the local publication, *Nuovo Giornale*.[14]

The Scottish surgeon William Macewen of Glasgow, who was a follower of Lister, performed the first documented successful removal of a brain tumor in 1879. The patient was a 14-year-old girl; she lived for 8 more years. The tumor was likely a supraorbital meningioma. He would prep the scalp with soap, water, turpentine, carbolic acid, and methylated spirits and used a protective dressing of plaster and carbolized gauze.[14–16] Macewen also oper-

Brought to you by Johns Hopkins University | Unauthenticated | Downloaded 07/05/25 01:34 PM UTC

FIG. 2. Examples of the unique pediatric head bandages. © Alan R. Cohen, published with permission. Figure is available in color online only.

ated on brain abscesses, dusting the brain with boric acid powder before applying an iodoform gauze dressing sterilized by moist heat.[17]

In 1884, Rickman Godlee of London, England, Lister's nephew, was the first to resect a primary brain tumor. In a celebrated operation, he removed a glioma from a 25-year-old Scottish farmer using finger dissection and dressed the wound with carbolic acid–soaked gauze. Four days later, the wound was opened and pus was drained. The patient died from overwhelming meningitis 28 days after surgery.[14,18]

In the modern era, there continues to be debate about the optimal way to care for surgical wounds of the head to promote healing. Multiple techniques for dressing cranial wounds have been proposed, with some surgeons advocating for no dressing at all.[4,19] We acknowledge that there can be downsides to universal bandaging,[4,20] but believe wrapping head wounds in children can help prevent digital manipulation, obliterate dead space, minimize bleeding, and improve postoperative aesthetics by concealing the scar. It is the last point that motivated us to create the novel turbans for our pediatric patients.

The Novel Hopkins Flap Wrap

In the age-old discussions about upsides and downsides of bandaging cranial wounds, little attention has been paid

Brought to you by Johns Hopkins University | Unauthenticated | Downloaded 07/05/25 01:34 PM UTC

to psychosocial factors unique to the postoperative neurosurgical care of children. A pediatric craniotomy is a life-changing event for the patient and entire family, generating tremendous levels of anxiety. We have found that the simple creation of a light-hearted turban designed for children can do a lot to reduce apprehension across the board and improve the doctor-patient-family relationship.

The designer flap wrap is inexpensive and easy to create using material already available in the OR. Variations can be made and the act of constructing the bandage can serve as a team-building wellness exercise, with contributions from the nursing staff, residents, and attendings. When parents see their child for the first time after intracranial surgery, it is always an emotional moment. When they see their child looking like a puppy, monkey, or unicorn, for instance, they almost always break down with tearful relief that the operative ordeal is over.

As word spread throughout our medical center, kids often came to us preoperatively with specific requests for the turban they wanted to be wearing when they awoke. We now routinely offer age-appropriate patients a role in choosing the style of their wrap. Consequently, we have prepared a menu of available head bandage selections for them to choose from. This gives kids and families something enjoyable to focus on, helping to divert their attention from the seriousness of the day (Fig. 2).

Acknowledgments

We thank Megan Meyers, Emma La Forest, and Lucy Hicks for their invaluable assistance in creating the unique head turbans.

References

1. Lv X, Li Z, Li Y. Prehistoric skull trepanation in China. *World Neurosurg*. 2013;80(6):897-899.
2. Ahmad W, Aquil Z, Alam S. Historical background of wound care. *Hamdan Med J*. 2020;13(4):189-194.
3. Carroll E, Lewis A. Prevention of surgical site infections after brain surgery: the prehistoric period to the present. *Neurosurg Focus*. 2019;47(2):E2.
4. Winston KR, McBride LA, Dudekula A. Bandages, dressings, and cranial neurosurgery. *J Neurosurg*. 2007;106(6 suppl):450-454.
5. Lionelli GT, Lawrence WT. Wound dressings. *Surg Clin North Am*. 2003;83(3):617-638.
6. Ovington LG. The evolution of wound management: ancient origins and advances of the past 20 years. *Home Healthc Nurse*. 2002;20(10):652-656.
7. Shah JB. The history of wound care. *J Am Col Certif Wound Spec*. 2011;3(3):65-66.
8. Simmons B. *The New Testament, with Psalms, Proverbs and Song of Songs. The Passion Translation*. Broadstreet; 2020.
9. Broughton G, II, Janis JE, Attinger CE. A brief history of wound care. *Plast Reconstr Surg*. 2006;117(7 suppl):6S-11S.
10. Majno G. *The Healing Hand*. Harvard University Press; 1975.
11. Brandt-Rauf PW, Brandt-Rauf SI. History of occupational medicine: relevance of Imhotep and the Edwin Smith papyrus. *Br J Ind Med*. 1987;44(1):68-70.
12. Forrest RD. Early history of wound treatment. *J R Soc Med*. 1982;75(3):198-205.
13. Miller JT, Rahimi SY, Lee M. History of infection control and its contributions to the development and success of brain tumor operations. *Neurosurg Focus*. 2005;18(4):e4.
14. Cohen AR. William Macewen and the first documented successful resection of a brain tumor. *Childs Nerv Syst*. 2023; 39(11):3019-3024.
15. Macmillan M. Localisation and William Macewen's early brain surgery part I: the controversy. *J Hist Neurosci*. 2004; 13(4):297-325.
16. Macmillan M. Localization and William Macewen's early brain surgery part II: the cases. *J Hist Neurosci*. 2005;14(1): 24-56.
17. Canale DJ. William Macewen and the treatment of brain abscesses: revisited after one hundred years. *J Neurosurg*. 1996; 84(1):133-142.
18. Bennett AH. Case of cerebral tumour. *Med Chir Trans*. 1885; 68:243-275.
19. Merei JM. Pediatric clean surgical wounds: is dressing necessary? *J Pediatr Surg*. 2004;39(12):1871-1873.
20. Demir Y, Yilmaz MD, Haktanir N. Dangers of a tight head dressing. *Aesthetic Plast Surg*. 2004;28(4):256.

Disclosures

The authors report no conflict of interest.

Supplemental Information

Previous Presentations

This work was presented as an oral report at the annual meeting of the American Society of Pediatric Neurosurgeons, Aruba, January 26–31, 2025.

Correspondence

Alan R. Cohen: alan.cohen@jhmi.edu.

INCLUDE WHEN CITING
Published online July 4, 2025; DOI: 10.3171/2025.3.PEDS2597.

©AANS 2025, except where prohibited by US copyright law

Brought to you by Johns Hopkins University | Unauthenticated | Downloaded 07/05/25 01:34 PM UTC