



Navy Capt. Kristen Zeller, an ophthalmologist embarked aboard the Military Sealift Command hospital ship USNS Comfort (T-AH 20), and Hospital Corpsman 3rd Class Michael Peterson, a surgical technologist, perform surgery to correct strabismus, or cross-eye, on an eight-month-old Nicaraguan boy in the operating room aboard Comfort.

U.S. Air Force photo by Airman 1st Class Benjamin Stratton

Pediatric Strabismus Surgery

LATISHA ALLEN, CST

Vision during childhood can be affected by a wide range of issues including common myopia (nearsightedness), amblyopia (lazy eye) and strabismus (cross-eyed). In the United States, about 4% of all children have strabismus.^{1,6} According to the American Academy of Ophthalmology, strabismus is a visual problem in the alignment of the eyes. The condition presents as eyes pointing in different directions, often with one straight. For example: one eye looks forward, while the other turns inward or downward. The degree of misalignment can vary, come and go, or switch to the other eye.¹

CAUSES

In infants and children, two types of strabismus may be present: **infantile esotropia**—where the eye turns inward and the infant cannot use both eyes together or **accommodative esotropia** (present in children two years of age or older)—where the eyes turn inwardly when the child focuses both eyes to see clearly. With this type of strabismus, the eyes tend to cross when the child is focusing at a distance, up close, or both. Depending on the problem, one or both eyes may need surgery.¹

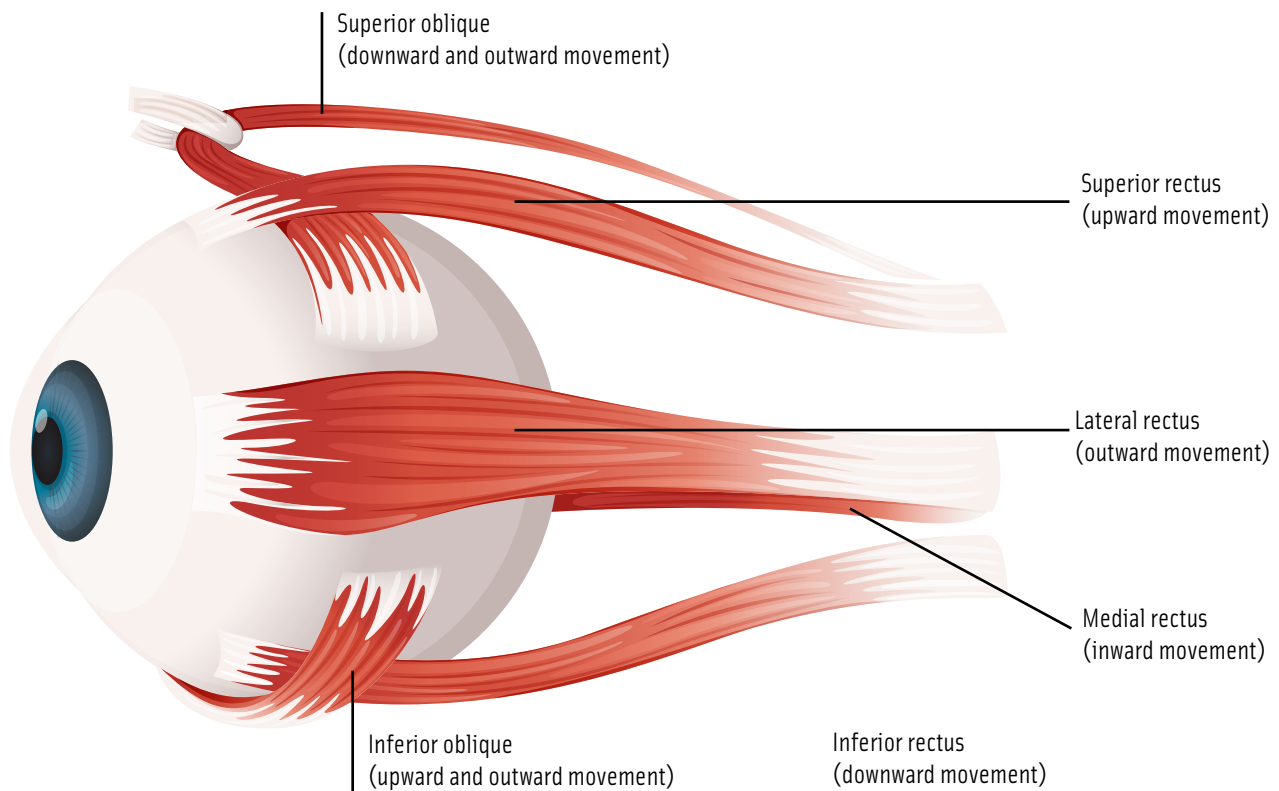
Strabismus can be linked to heredity and neurological problems or can be completely unrelated. If genetic, there may be no relatives who have presented with the problem.²

Brain function disorders linked to strabismus include prematurity, cerebral palsy, brain tumors, hydrocephalus and Down syndrome.² A cataract or eye injury that affects vision can also cause strabismus.

LEARNING OBJECTIVES

- ▲ Learn the conditions and anatomy associated with pediatric ophthalmologic surgery
- ▲ Examine the testing and indications for strabismus surgery
- ▲ Review the set up and draping protocols specific to this procedure
- ▲ Learn the step-by-step process involved
- ▲ Explain the anticipated outcome for the patient

MUSCLES OF THE HUMAN EYE



ANATOMY

Three pairs of extraocular muscles per eye are responsible for generating its movements.² They are:

1. Lateral rectus (LR) – outward movement
Medial rectus (MR) – inward movement
2. Superior rectus (SR) – upward movement
Inferior rectus (IR) – downward movement
3. Superior oblique (SO) – downward and outward movement
Inferior oblique (IO) – upward and outward movement

Movement of the eyes requires that each muscle work together with its pair.² When one contracts, the opposite muscle relaxes.

To focus on an object or target, all of the muscles of the eye must be balanced and working together. With normal vision, both eyes are able to focus on one target. The brain then combines the two pictures into a single, three-dimensional image, which creates depth perception. However, when one eye is out of alignment, the brain receives signals with two different pictures. In young children, the brain adapts to the image being misaligned and the child

To focus on an object or target, all of the muscles of the eye must be balanced and working together.

sees only the image from the straight, or better eye, causing the child to lose depth perception.⁶

Three cranial nerves (III, IV and VI), controlled by the brain, manage movement of the eye muscles.² Strabismus surgery addresses the muscular problems of the eye (alignment), not issues with the brain's signals to the muscles or interpretation of the image.⁷

TREATMENT

Only about 25% of strabismus cases require surgical treatment.² Nonsurgical pediatric treatment may consist of glasses, prisms, patching or blurring of one eye, Botox injections, or a combination of these treatments.¹ For children affected by strabismus, if these methods fail to work, then eye muscle surgery (recession or resection) is often the best option to ensure successful developmental and optional vision later in life.

PREOPERATIVE TESTING AND INDICATIONS

All appropriate evaluations should be performed prior to considering and performing strabismus surgery. In some cases, the eyes of an infant may appear to be crossed when, in fact, they are not. This is called pseudostrabismus.

First, eye measurements are taken by means of a sensorimotor examination. The known working diagnosis must be consistent and reliable in relation to the deviation of the measurement of the eyes. Second, prisms are used to measure the degree of the strabismus. Any vision problems should be addressed. Furthermore, the sensory status of the eye or synergy of the eye muscles should be evaluated. Then the overall general health status of the child/infant should be assessed to affirm that undergoing anesthesia will be safe. Finally, the doctor or surgeon will discuss several factors with the parents including, but not limited to: potential risks, benefits of the procedure, limitation of the surgical correction, possible alternatives to surgery, timing, etc.

Depending on the test results, the surgeon will determine which type of strabismus procedure will be performed. It can be done as a **resection** – shortening of the muscle(s) or tendon(s) by removing a section of it, which then strengthens the muscle or as a **recession** – weakening the muscle(s) by disconnecting and reattaching it farther in the back of the eye.

The procedure to correct an **esotropia** (eye turned inward), for example, will consist of recessing the medial rectus of each eye or one medial rectus and one lateral rectus muscle. If the deviation is large enough, there could be a combination of either process.²

Correction of an **exotropic** angulation (eye turned outward) would consist of recessing the lateral rectus of each eye (for small exotropic angles of deviation), detaching and reattaching one lateral rectus muscle and one medial rectus muscle (an aggregate of one or both procedures).²

For **hypertrophic** separation (eye turned upward), one or more of the vertical rectus muscles (superior and infe-

Surgical Supplies
ENT drapes- split sheet and bar drape
Sterile water
Povidone-iodine prep sticks
Normal saline
(2) White paper towels: one to blot of excess prep solution and the other to place on top of Mayo stand cover/Mayo stand. Do not use the blue towels because the fibers could get into the eye.
(2) 5/8 x 11.75 in. plastic drapes: to drape the eye
Several packages of spear-shaped eye sponges
27 g disposable or non-disposable cannula for local syringe
Skin marker for labeling solutions
Instrument wipe pad
(2) 2.375 x 2.75 in. transparent dressings to cover each eye during surgery (used one at a time)
Eye pad (have available)
4x4 pads (have available)
(4) 6-0 polyglactin 910 absorbable sutures on a spatula needle (5-29) and (1) 8-0 polyglactin absorbable suture cut in half. If laterality is bilateral or more than one muscle is being repaired, then (8) 6-0 polyglactin sutures will be used and (1-2) 8-0 polyglactin sutures will be needed.
Surgeon and tech gown and gloves
Towels: to dry the hands of surgical staff performing procedure
Tobramycin/dexamethasone ointment: to keep the eye lubricated
(1) 3cc syringes: one for local anesthetic- surgeon's preference
(1-2) tuberculin slip tip syringe: one for monifloxacin antibiotic drops and the other for phenylephrine drops
21 g hypodermic needle to draw up local anesthetic
Blue bowl
Light handles
Bipolar cord and Jeweller's bipolar forceps
Needle box

rior) will be egressed or one or more of the oblique superior and inferior muscles will be weakened. If the inferior oblique muscles are weakened, the surgeon may perform a recession and *myectomy*, or prevention of stimulation of the muscles surrounding the eye by surgical removal.³ If the superior oblique muscles are weak, then a *tenotomy* – surgical cutting of a tendon in order to lengthen a muscle, *tenectomy* – surgical resection of part of a tendon, muscle recession, or lengthening with spacers are performed.^{3,4,5}

STRABISMUS PROCEDURE

The supplies and equipment are all gathered and checked for surgical integrity. The surgical tech begins by opening all sterile supplies needed for the procedure by using sterile technique. The eye muscle tray is then opened by popping the sterilization tabs and the lid is lifted in the correct form. Any filters must be removed and checked for holes and tears. If any are found, the tray must be considered contaminated. Furthermore, another tray of instruments should be opened, checked, and used accordingly. After the surgical scrub, the tech then dons the gowns and gloves using the open-glove technique. The tray is then gathered up by the tech without contaminating him/herself and the

bottom of the pan is checked by the nurse for wetness, retained items, etc. Once the tray is cleared, it is placed on the backtable, along with the instruments on the Mayo stand, according to surgeon's preference.

The Mayo stand will be draped and lined with a white paper towel; whereas using the blue linen towels could cause the towel fibers to be transferred from the instrumentation and supplies into the eye. The surgical technologist labels all solutions and medications given by the circulating nurse (sterile water, tobramycin/dexamethasone combination eye ointment, local anesthetic, moxifloxacin antibiotic eye drops, and/or phenylephrine drop (if being used for procedure) that are placed on the field by using a sterile marking pen. The 6-0 sutures (2-4 depending on how many muscles are being excised) are loaded on the Castroviejo needle drivers. The 8-0 suture (1) is cut in half and placed safely in the needle box until it is time for it to be used.

The patient is brought into the OR suite and transferred to the OR bed. The circulating nurse begins positioning the patient: placing safety straps and padding devices, applying blood pressure cuffs, and other monitoring and forced air warming devices. Compression stockings and hose are not needed on pediatric patients. Anesthesia then sedates the patient and places and secures any additional IVs for medicinal and fluid access. The surgeon then administers any preoperative eye drops and/or antibiotic drops.

With the assistance of the anesthesia staff, the surgeon places a shoulder roll under the patient's back and a donut positioning device is placed under the child's head. The bed is unlocked and turned 90 degrees. The circulator then preps the eye(s) from the forehead to the nose (both sides if both eyes are being worked on) by using povidone-iodine sticks mixed with saline.

The surgeon then puts on the surgical loupes and leaves to perform a surgical scrub. The surgical tech hands the surgeon a towel to dry their hands and begins to don the gown and gloves of the surgeon. The draping procedure then begins. No first assistant is needed for the procedure. The surgical tech or surgeon blots the excess prep solution with a white paper towel. Again, no blue towels should be used the surgery because of the risk of the fibers being trapped in the eye and could cause infection and/or eye problems).

The tech holds each 10"×10" drape so that the film may be peeled away by the surgeon. One drape is placed above the eyebrow and the other across the bridge of the nose. The surgical tech then hands the surgeon the bar drapes for the head. Next, the tech places the split sheet on the patient's chest and the surgeon and tech both unfold the drape from side to side first and then down. The tabs are removed from the back and the drape

Instruments and Equipment
Sitting stools
Surgical loupes
Eye cart
ESU Wetfield bipolar machine
Eye muscle set: <ul style="list-style-type: none"> (2) 5" Westcott stitch scissors (one blunt, one sharp) (2) Straight Castroviejo needle holders with locking handle (1) 4" Curved Hartmann mosquito (2) .3 mm Castroviejo forceps (2) 4-1/4" Moody fixation forceps with locking handle (2) Desmarres lid retractors #0 and #1 (2) Barraquer eye speculums (one child and one adult) (1) 5-3/8" small 9 mm Jameson muscle hook (2) 11mm Jameson muscle hooks (2) Curved Stevens tenotomy hooks (3) Curved Havelston retractors (7 mm, 9 mm, 11 mm) (1) Castroviejo eye caliper (1) Halveston scleral ruler (2) 10 mm serrated bulldog clamps

is fastened around the perimeter of the head. The surgical technologist then hands the surgeon a small piece of transparent dressing to cover the eye that is not being operated on. The surgical technologist then throws off the bipolar cord and attaches the Jeweller's bipolar forceps to the appropriate attachment, while the surgeon attaches the light handles.

Both the surgeon and the surgical technologist sit during the procedure. The Mayo stand is pulled up to the crown of the head. The surgeon will sit on the side that will be operated on first and the technologist sits on the other. A timeout is then called by the circulator and then the procedure will begin.

First, the surgeon will place a Barraquer eye speculum in the eye to hold it open. An eye ointment containing a combination of antibiotic and steroid will be smeared across the eye using an eye hook. Then the surgeon will make a tiny incision in the sclera of the eye by means of a Castroviejo tenotomy scissor and forceps. After the incision is made, local anesthetic will be administered into the infused space via a 27-gauge cannula. The surgical technologist then hands the surgeon a spear-shaped eye sponge to blot away the excess fluid from the eye. The surgeon then takes two Moody forceps and attaches one to each side of the incised sclera. The surgical technologist then gently holds them in place.

Two muscle hooks are then used to expose the muscle. One is placed under the muscle and the tissue covering the muscle is excised for exposure. The other hook is used for retraction of the sclera on the other side of the muscle. Once the muscle is visualized and identified, either a mosquito clamp is placed on it to mark it or two 6-0 polyglactin sutures are placed at the insertion point of the muscle (one on each side) and clamped with a bulldog clamp. Four sutures will be used if more than one muscle will be excised or removed. Moxifloxacin drops are then dropped into the eye and another eye spear sponge is used to blot the excess fluid. The antibiotic/steroid combination ointment is applied as needed to lubricate the eye.

The Castroviejo scissors are again used to cut the muscle at the point of insertion of the eye. While the surgical tech maintains the exposure, the surgeon then uses the caliper to measure



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the distance, or point where he/she will reattach the muscle. Depending on the measurement, part of the muscle is removed and sutures placed, both with 6-0, before they are cut. The local and moxifloxacin are used interchangeably as needed. The 8-0 is then used to close the sclera. The surgeon will then repeat the above procedure on the other eye if needed. The surgical technologist's main responsibility is to make sure that all instruments are kept clean wiped of excess blood and debris.

OUTCOMES

All treatment options should be explored before parents consider surgical treatment for their child. Peer reviewed scientific studies report success rates for eye-muscle surgeries that range from 30% to 80%.⁷ Improvement is greater for alignment of the patient's eyes, with more variance in the patient's improvement in vision. Multiple surgeries may be needed over time to correct both. Age, type of strabismus and nonsurgical treatments all play a role in an individual's success.^{6,7}



ABOUT THE AUTHOR

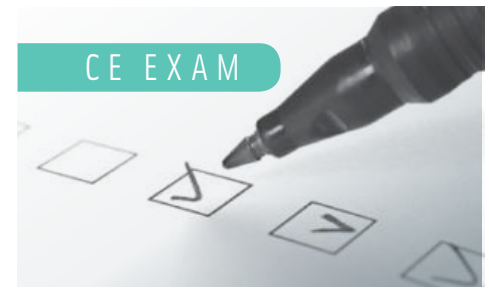
LaTisha Allen, CST, has been a preceptor at Mercy Hospital in St. Louis for two years and is a member of ENT, pediatrics and OMF team; however, she scrubs other specialties also. She received her associate degree in surgical technology in 2010 from Allied College in St. Louis and was certified

that year. She first started her career at Touchette Regional Hospital in Centerville, Illinois. She then worked for Midwest Institute as a surgical tech instructor in 2015. This summer, LaTisha completed a certificate program from the Meridian Institute of Surgical Assisting. In September, she will begin the doctor of chiropractic program at Logan University in Chesterfield, Missouri. She is also serving as treasurer for the AST Missouri State Assembly. Before being elected as treasurer, she served as a director on the board.

LaTisha enjoys writing; is grateful to her daughters Jailyn, Cyara and Angel for motivating her to strive to be her best. She extends a special thank you to her favorite surgeon, Steven Goodrich, MD, of Mercy Hospital for the inspiration for writing this article; her coworker, Rosa Williams, for training her to scrub ophthalmic surgery; her supervisors and department managers – Lynn Close, Toni Kanne, Laura Truskowski and Gens Fish – for their support; and, Carl and Taunja Bargney for their encouragement and support in everything that she does.

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1. **What is the common term for strabismus?**
 - a. Lazy eye
 - b. Nearsightedness
 - c. Cross eyed
 - d. Common myopia

2. **In what type of strabismus do both eyes turn inward in order to focus?**
 - a. Accommodative esotropia
 - b. Infantile esotropia
 - c. Pseudostrabismus
 - d. Hypotropia

3. **Which is also true about strabismus?**
 - a. The degree of misalignment can vary.
 - b. The misalignment can switch eyes.
 - c. The misalignment can be inconsistent (come and go).
 - d. All of the above

4. **Strabismus affects ___ of children in the United States.**
 - a. 4%
 - b. 14%
 - c. 50 of 100
 - d. 25%

5. **What happens when a child's brain adapts to see only the image produced by the good eye?**
 - a. Cataracts
 - b. Loss of depth perception
 - c. Physical imbalance
 - d. Temporary blindness

6. **Which instrument is placed to hold the eye open?**
 - a. Castroviejo tenotomy forceps
 - b. Barraquer eye speculum
 - c. Moody forceps
 - d. Halveston retractors

7. **Which absorbable suture is used to close the sclera?**
 - a. 6-0
 - b. 7-0
 - c. 8-0
 - d. 9 mm

8. **For patient safety, which should NOT be used during pediatric strabismus surgery?**
 - a. Blood pressure cuff
 - b. Compression stockings
 - c. Hose
 - d. Blue linen towels

9. **Which muscle pairs are mismatched?**
 - a. Lateral rectus and inferior rectus
 - b. Superior rectus and inferior rectus
 - c. Inferior oblique and superior oblique
 - d. Medial rectus and lateral rectus

10. **Which may NOT improve with strabismus surgery?**
 - a. Vision
 - b. Eye alignment
 - c. Appearance (cosmetic/aesthetic)
 - d. Recurrence

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