



ZIMMER BIOMET

Your progress. Our promise.®

TAKE A DEEP BREATH TOWARDS RECOVERY

Rib Fixation Patient Education

Rib fractures are one of the most common injuries following blunt trauma, occurring in approximately 10 percent of all trauma patients.¹

Traumatic Rib Injuries can be painful and debilitating, fortunately there are options.



Table of Contents

Benefits of Rib Fixation 4-5

About Rib Fixation 6-8

Diagnosis & Treatment 9-10

Surgical Treatment Options 11-12

Rib Fixation Risk Information 13-15



A close-up photograph of a Black man and a young Black woman embracing each other. The man is on the left, smiling broadly with his eyes closed. The woman is on the right, also smiling broadly, looking towards the camera. They are both wearing light blue button-down shirts. The background is a soft, out-of-focus green, suggesting an outdoor setting. A semi-transparent blue banner is overlaid across the bottom half of the image, containing the title text.

Benefits of Rib Fixation

Benefits

Rib fractures are one of the most common injuries, occurring in approximately 10 percent of all trauma patients.¹ Compared to non-surgical treatment the **Benefits of rib fixation may include:**



69% lower risk of mortality¹³

The majority (7/10) of reviews found significant reductions in mortality rate (between 56% and 76%) for patients undergoing surgical rib stabilization when compared to conservative treatment.



4.95 days fewer days of mechanical ventilation⁸

Studies of patients reporting mechanical ventilation after surgical rib stabilization found a reduction of days that a mechanical ventilator was needed.



4.5 fewer days in the ICU^{12, 13}

ICU length of stay was found to be significantly shorter for surgical rib stabilization patients. Reported reductions range from 2 days to 6.5 days through various studies.



7.4 fewer days in the hospital¹¹

Hospital length of stay was found to be shorter for surgical rib stabilization patients in all but one. Reductions in hospital stay range from 3.8 fewer days to 11.4 fewer days.



61% less risk of pneumonia^{8, 9, 10}

Benefits from surgical rib stabilization ranged from 41% to 82% lower risk of pneumonia.



66% less risk of tracheostomy⁸

Patients who had surgical rib stabilization have shown to have a range of 41% lower to 88% lower risk of tracheostomy, an opening in the neck to place a tube into a person's windpipe.

What are the risks associated with the surgical stabilization of rib fractures?

As with most surgery, comes risk. To help minimize risk, it is always important to follow your surgeon's post-operative precautions.

Know Your Options. Talk To Your Surgeon.

Rib fractures are among the most common injuries occurring in approximately 10 percent of all blunt trauma patients.⁷ Fortunately, there are options available to support your healing process, depending on the severity of the fracture.

As you prepare for surgery, you may want to review your surgeon's options for rib fixation. Knowing your options will allow you to make an informed decision on what fixation system will most effectively stabilize your rib(s), minimize pain, and help get you back to the activities that you enjoy most.

Zimmer Biomet provides the most comprehensive rib fixation solutions with RibFix Advantage™ Fixation System and RibFix Blu® Thoracic Fixation System. RibFix Advantage is an innovative technique that allows for a less invasive approach, from inside the chest wall. RibFix Blu is a traditional technique utilizing plates and screws to secure the rib.

Rib fracture fixation results will vary due to the severity of injuries, health, weight, activity, and other variables. Not all patients are candidates for this product and/or procedure. Only a medical professional can determine the treatment appropriate for your specific condition.

About rib fractures

Your rib cage plays an essential part in protecting the lungs, heart, and other vital organs which is also called the thoracic cavity. When a trauma injury to the chest occurs, such as a car accident or fall, it may result in broken or fractured ribs.

What is a fractured rib?

A rib fracture is a crack or break in one of the bones of the rib cage. Ribs with a minor fracture are potentially not as dangerous but could still be painful. However, a jagged edge of broken rib bone can damage internal organs and pose a more significant risk.



Types of rib fractures

Different types of rib fractures vary and may require different treatments. Only a healthcare professional can accurately diagnose your injuries.

Isolated Rib Fracture

Less severe fracture with one or two broken ribs. Patients with this rib fracture may not be a candidate for surgical treatment.

Multiple Rib Fractures

Three or more rib fractures can be considered more severe. Patients with this rib fracture are possible candidates for surgical treatment.

At times, broken ribs can heal on their own. Depending upon the severity of rib fractures, treatment options may vary. It's essential to know your treatment options for your type of fracture.

How do people break ribs?

The most common cause of a rib fracture is a direct impact to the chest, which can occur during various activities. However, some conditions can lead to a broken rib without being hit very hard, including osteoporosis or cancerous lesions that weaken bones.



AUTOMOTIVE ACCIDENTS

Motor vehicle accidents are among the most common causes of rib fractures in adults.³ Due to the impact during a collision, the driver may fracture a rib when coming into contact with a seatbelt, steering wheel, or even the dashboard.



FALLS

The most common cause of injury for rib fractures in the elderly is a fall. Each year, 2.5 million older people are treated in emergency departments for fall injuries. More than 700,000 patients a year are hospitalized because of a fall injury.³ Elderly patients who sustain blunt chest trauma with rib fractures have twice the mortality and thoracic morbidity than younger patients.²



CONTACT SPORTS

Physical activity, including contact sports, is the most common cause of rib fractures in young adults.³ Any game in which extreme contact occurs has a risk of damage to the ribs, resulting in rib fractures.



SEVERE OR PROLONGED COUGHING

If a cough is severe enough, generally due to another underlying issue, it could result in a fractured rib. Repeated motions, such as prolonged coughing, cause stress that may result in a broken rib.

Rib fractures are one of the most common injuries following blunt trauma, occurring in approximately 10 percent of all trauma patients. More than 350,000 patients sustain rib injuries annually in the United States, and significant trauma centers admit patients with rib fractures daily.²

How to tell if you have a broken rib?⁵

Sharp chest pain can occur when you have a broken rib. Here are a few signs that may tell you it's time to visit your physician:

- ✓ Your chest hurts when you take a deep breath
- ✓ Your pain increases when you twist your body
- ✓ Coughing or laughing causes pain

Steps to diagnosis

Consult your doctor if you have chest pain believed to be linked to a fractured rib. Your doctor will recommend a complete CT Scan or X-ray to identify fractures and the severity of injuries. Find out what happens during diagnosis and what treatment options are available.

An elderly couple is shown outdoors, smiling and looking upwards. The man, on the left, is wearing a red polo shirt and has his right arm raised, pointing his index finger towards the sky. The woman, on the right, is wearing a dark top and has her hand on the man's shoulder. The background is a soft-focus green landscape. A blue semi-transparent banner is overlaid across the middle of the image, containing the text 'Diagnosis & Treatment' in white.

Diagnosis & Treatment

Diagnosis

Upon injury, there may be signs of bleeding or bruising externally as well as difficulty breathing. If you or a loved one believe you have a broken rib, consult a doctor for guidance. It's essential to get correctly diagnosed to rule out more severe injuries and learn about treatment options that can help your recovery.

After completing a physical examination where your doctor may press gently on your ribs and listen to your chest, he or she may recommend the following tests to identify fractures and the severity of injuries:⁵

X-Ray: X-rays use low levels of radiation to make bones visible. X-rays often have problems revealing fresh rib fractures, especially if the bone has a small crack.⁵

CT Scan: This often can uncover rib fractures that X-rays might miss. CT scans expose injuries to soft tissue and blood vessels by taking X-rays from various angles and combining them to show your body's internal structures.⁵

MRI: An MRI uses a powerful magnet and radio waves to build images of the soft tissue in your chest and organs around the ribs to determine if there is damage and reveal subtle rib fractures if present.⁵

Bone Scan: A small amount of radioactive material is injected into your bloodstream. It collects in the bones and is detected by a scanner to view stress fractures caused by repetitive trauma (i.e., a lot of coughing).⁵

Once you receive a fractured rib diagnosis from your doctor, you may have two options for treatment: conservative non-surgical treatment or surgical treatment.

Conservative Non-Surgical Treatment

If fractures are not as severe, your doctor may recommend bed rest and pain therapy. Most broken ribs potentially heal on their own within six weeks with restricting activities and icing the area regularly, which can help with healing and pain relief.⁵ Depending on your pain level, your doctor might prescribe something you can take for pain relief or an injectable form of anesthesia to help numb the nerves directly around the rib in the first few days following a rib fracture.⁶

Once the pain is under control, your doctor might prescribe breathing exercises or respiratory therapy to help you breathe deeply. Continued shallow breathing may put you at risk of developing pneumonia.⁵

Surgical Treatment

If you or a loved one has multiple fractured ribs or severe chest damage, surgery may be needed. During the procedure, your surgeon may implant a metal device to secure the fractured rib into place, called surgical fixation. This implant is permanent and not meant to be removed.

Several clinical studies show that patients treated with surgical fixation may benefit when compared to the conservative treatment, such as:

- Lower Risk of Mortality**
- Fewer Days of Mechanical Ventilation**
- Fewer Days in ICU**
- Shorter Stay in the Hospital**
- Lower Risk of Developing Pneumonia**
- Lower Risk of Tracheostomy**



Surgical Treatment Options

What is the surgical stabilization of rib fractures?

Surgical treatment for a broken rib is often referred to as Surgical Stabilization of Rib Fractures (SSRF). This method uses titanium plates to stabilize rib bones as they heal by holding the ribs in place. It has shown to be a potentially more effective method for rib fracture management than non-surgical conservative treatments.¹ **Zimmer Biomet currently offers two treatment options for patients that need rib fixation:**

What is RibFix Advantage?

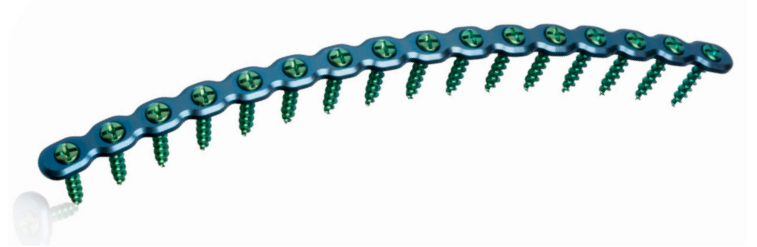


RibFix Advantage is a less-invasive approach to rib fracture repair. Using a system of metal bridges and posts, this system offers less muscle disruption. The product is designed to fit against the rib's natural arch, leading to restored stability at the fracture site. Surgery is performed while the patient is asleep under general anesthesia.

The procedure generally follows these steps:

- ✓ Once the fracture is identified, a surgeon will make a reduced-size incision, the scope entry point. This less-invasive surgery uses a camera to ensure the correct placement of the implant.
- ✓ The surgeon will then drill into the center of the rib on either side of the fracture, creating a guide so the device can secure rib placement.
- ✓ During the procedure, the implants are placed on the inside of the rib to stabilize the fracture.

What is RibFix Blu?



While RibFix Advantage is attached to the inside of the rib, RibFix Blu is a rigid fixation system of metal plates and screws connected on the outside of the rib bone to stabilize the fracture site helping facilitate the healing process. Surgery is performed while the patient is asleep under general anesthesia.

The procedure generally follows these steps:

- ✓ Fracture identified using CT Scan and skin is marked to identify location of fracture.
- ✓ The incision is made over the fractured rib to gain access to the injury.
- ✓ The surgeon will then bring the two broken segments together and attach a titanium plate to the top side of the bone with screws.



What Are The Risks Associated With Rib Fixation?

Rib Fixation Risk Information

As with most surgery, comes risk. To help minimize risk, it is important to follow the post-operative care instructions provided by your surgeon and attend regular follow-up appointments. See below for the risks associated with the Zimmer Biomet Rib Fixation products.

The RibFix Blu system is indicated for use in the stabilization and fixation of fractures in the chest wall, including sternal reconstructive surgical procedures, trauma, or planned osteotomies. While uncommon, complications can occur during and after surgery. Complications may include, but are not limited to:

- ◆ Poor bone formation, Osteoporosis, Osteolysis, Osteomyelitis, inhibited revascularization, or infection can cause loosening, bending, cracking or fracture of the device.
- ◆ Nonunion or delayed union which may lead to breakage of the implant.
- ◆ Migration, bending, fracture or loosening of the implant.
- ◆ Metal sensitivity; or allergic reaction to a foreign body.
- ◆ Decrease in bone density due to stress shielding.
- ◆ Pain, discomfort, abnormal sensation, or palpability due to the presence of the device.
- ◆ Increased fibrous tissue response around the fracture site and/or the implant.
- ◆ Necrosis of bone.
- ◆ Inadequate healing.
- ◆ Selection of screws which are longer than the depth of the bone may cause possible impingement on structures internal to chest wall including vessels, pleura and other structures.

Patients with any of the following conditions are not candidates for treatment with RibFix Blu:

- ◆ Spanning a midline sternotomy.
- ◆ Active infection
- ◆ Foreign body sensitivity. Where material sensitivity is suspected, testing is to be completed prior to implantation.
- ◆ Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions.

Rib Fixation Risk Information Cont'd

The RibFix Advantage System is indicated for the fixation, stabilization, and fusion of rib fractures and osteotomies of normal and osteoporotic bone. While uncommon, complications can occur during and after surgery. Complications include, but are not limited to:

- ◆ Nonunion or delayed union which can lead to breakage of the implant.
- ◆ Metal sensitivity, or allergic reaction to a foreign body.
- ◆ Limb shortening due to compression of the fracture or bone resorption.
- ◆ Decrease in bone density.
- ◆ Pain, discomfort, or abnormal sensations due to the presence of the device.
- ◆ Nerve damage due to surgical trauma.
- ◆ Necrosis of bone.
- ◆ Vascular changes.

Patients with any of the following conditions are not candidates for treatment with RibFix Advantage:

- ◆ Use in patients with latent or active infection, sepsis, and/or device material sensitivity.
- ◆ Use in patients who are unwilling or incapable of following postoperative care instructions.
- ◆ This device is not intended for locking post attachment or fixation to the clavicle or spine.

For a complete list of risks associated with Zimmer Biomet's RibFix Advantage and RibFix Blu Patient Risk information please visit our website <http://www.zbthoracic.com/rib-fracture-rib-fix-blu/>.^{14,15}



ZIMMER BIOMET
Your progress. Our promise.®

www.ribfixation.com
800-874-7711

The information herein is of a general nature and does not represent or constitute medical advice or recommendations and is for general education purposes only. The information includes descriptions of a medical device that a surgeon may choose for the repair of rib fractures.

Zimmer Biomet manufactures medical devices, including the rib fixation products that may be used by your surgeon. We do not practice medicine all questions regarding your medical condition must be directed to your doctor(s). Results with rib fixation products will vary due to health, weight, activity and other variables. Not all patients are candidates for this product and/or procedure. Only a medical professional can determine the treatment appropriate for your specific condition. Appropriate post-operative activities will differ from patient to patient. Talk to your surgeon about whether rib fixation is right for you and the associated risks, therewith, including but not limited to the risks of pain or discomfort, infection, fracture, breakage, movement or loosening of the implant, inadequate or permanent injury or death. For a complete list of risks associated with Zimmer Biomet's rib fixation products, see www.ribfixation.com risk page.

All content herein is protected by copyright, trademarks and other intellectual property rights, as applicable, owned by or licensed to Zimmer Biomet or its affiliates unless otherwise indicated, and must not be redistributed, duplicated or disclosed, in whole or in part, without the express written consent of Zimmer Biomet. © 2021 Zimmer Biomet

Citation

1. F.M. Pieracci, et al., Consensus statement: Surgical stabilization of rib fractures rib fracture colloquium clinical practice guidelines, *Injury* (2016), <http://dx.doi.org/10.1016/j.injury.2016.11.026>
2. E.M. Bulger, et al, Rib Fractures in the Elderly, *The Journal of Trauma: Injury, Infection, and Critical Care* (2000).
3. Pacific Thoracic Surgery
4. Perera, King, Flail Chest. NCBI Bookshelf.
5. Mayo Clinic.com Broken Ribs
6. <https://www.healthline.com/health/broken-rib#treatment>
7. Bemelman, M., de Kruijf, M. W., van Baal, M., & Leenen, L. (2017). Rib Fractures: To Fix or Not to Fix? An Evidence-Based Algorithm. *The Korean journal of thoracic and cardiovascular surgery*, 50(4), 229–234. <https://doi.org/10.5090/kjtcs.2017.50.4.229>
8. Liang YS, Yu KC, Wong CS, Kao Y, Tiong TY, Tam KW. Does Surgery Reduce the Risk of Complications Among Patients with Multiple Rib Fractures? A Meta- analysis. *Clinical orthopaedics and related research*. 2019;477(1):193-205
9. Coughlin TA, Ng JW, Rollins KE, Forward DP, Olliver BJ. Management of rib fractures in traumatic flail chest: a meta-analysis of randomised controlled trials. *The bone & joint journal*. 2016;98-b(8):1119-1125.
10. Cataneo AJ, Cataneo DC, de Oliveira FH, Arruda KA, El Dib R, de Oliveira Carvalho PE. Surgical versus nonsurgical interventions for flail chest. *The Cochrane database of systematic reviews*. 2015(7):Cd009919.
11. Liu X, Xiong K. Surgical management versus non-surgical management of rib fractures in chest trauma: a systematic review and meta-analysis. *Journal of cardiothoracic surgery*. 2019;14(1):45.
12. Kasotakis G, Hasenboehler EA, Streib EW, et al. Operative fixation of rib fractures after blunt trauma: a practice management guideline from the Eastern Association for the Surgery of Trauma. *Journal of Trauma and Acute Care Surgery*. 2017;82(3):618-626.
13. Slobogean GP, MacPherson CA, Sun T, Pelletier ME, Hameed SM. Surgical fixation vs nonoperative management of flail chest: a meta-analysis. *Journal of the American College of Surgeons*. 2013;216(2):302- 311.e301.
14. RibFix Blu IFU. 01-50-1605.
15. RibFix Advantage IFU. 01-50-1700.