SURGICAL TECHNIQUE
RIB PLATES AND LOCKING CORTICAL SCREWS

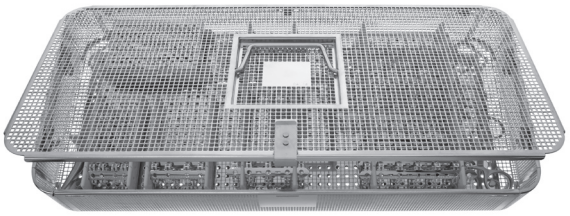
MEDIN®

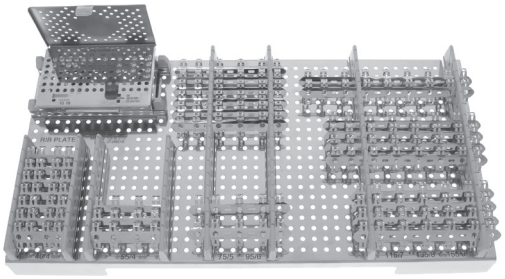
Instructions for use for rib plates – **IFU 3261**.

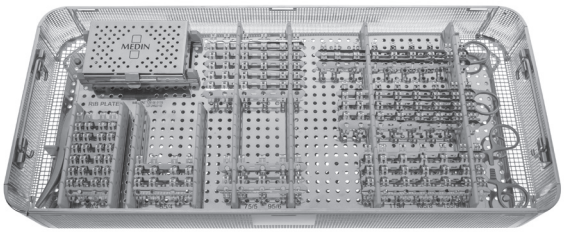
Medical device description

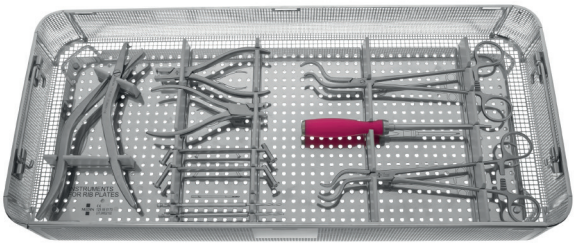
Indications of the rib plates

THE IMPLANT IS INTENDED FOR KEEPING THE SURFACE OF THE FRACTURED BONE TOGETHER TO FACILITATE A HEALING PROCESS OF THE FRACTURES. STABILIZATION USING THE RIB PLATES IS INDICATED AT THE FLAIL CHEST WITH A PARADOXICAL BREATHING, AT THE INJURY OF FOUR OR MORE RIBS AT THE THORACOABDOMINAL INJURIES, AT THE SERIAL IMPACTION OF THREE AND MORE RIBS WHEN PLEURA AND LUNGS HAVE BEEN DISRUPTED BY THE RIB FRAGMENTS WITH A WORSENING PNEUMO AND HAEMOTHORAX.









1. TECHNICAL PART

1. Rib plates and locking cortical screws

– rib plates (Fig. 1a)

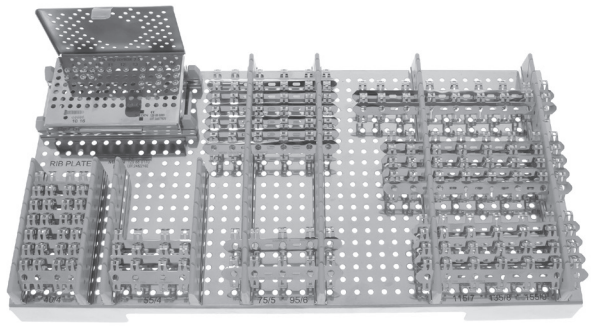


Fig. 1a

– stand with screws (Fig. 1b)

Fig. 1b

2. Types of the rib plates (further plates only)

(Marking of the plates - length in mm / number of pairs of the fixing arms). The plates are divided according to the fracture type:

– plates 40/4; 55/4
for a simple fracture or a fracture with one loose fragment from 70 mm (Fig. 2a)

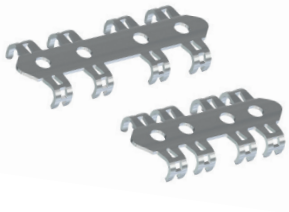


Fig. 2a

– plates 75/5; 95/6; 115/7; 135/8; 155/9
for a fracture with one or more loose fragments in a row up to 100 mm (Fig. 2b)

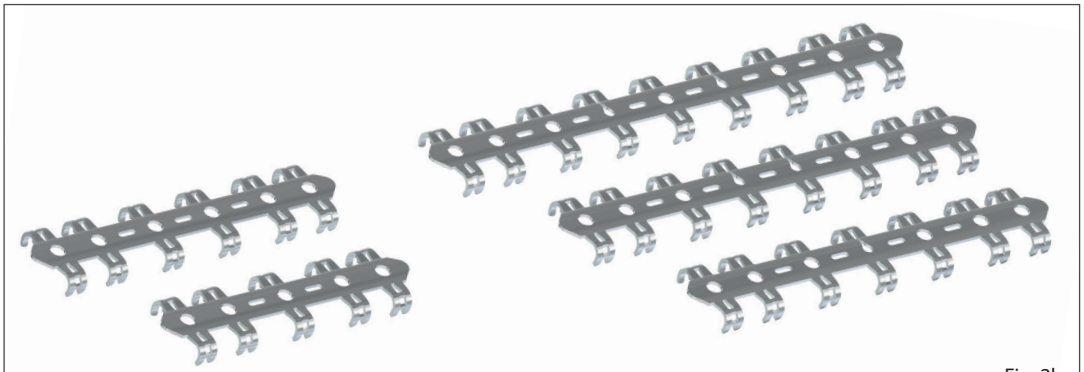
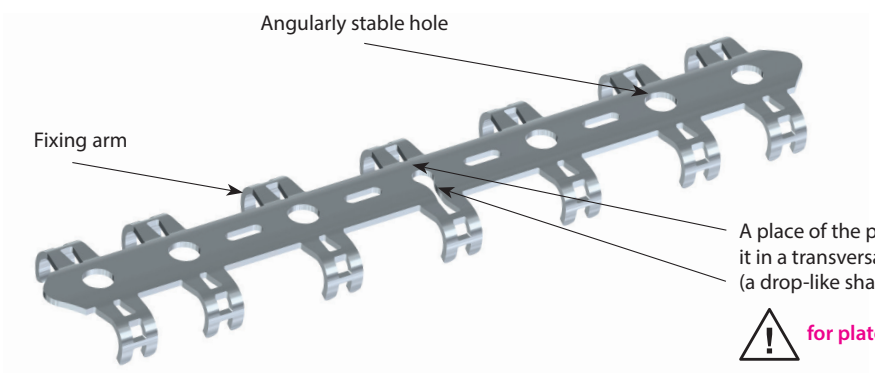


Fig. 2b

3. Functional parts of the plate

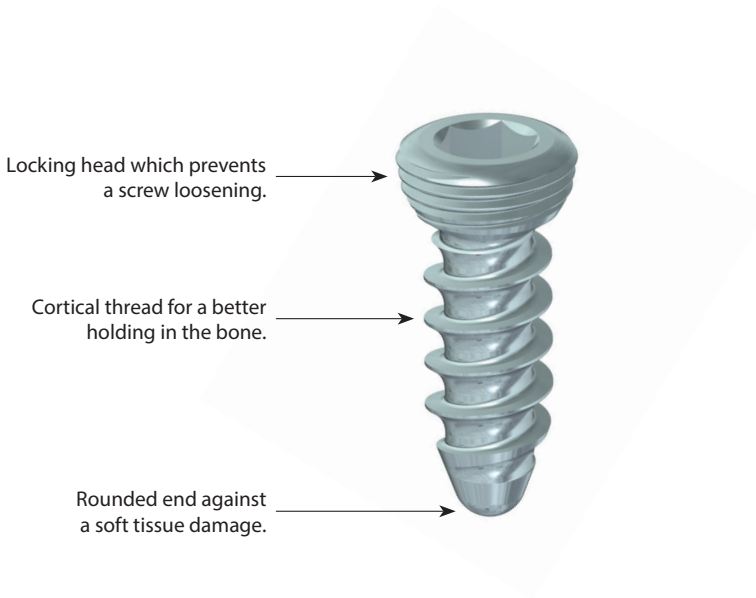


4. Types of the locking cortical screw (further screw only)

The screws are of the size of 3.5 mm and are available in the lengths from 7 up to 16 mm in 1 mm increments. It is possible to screw them with a screwdriver with hexagon of 2.5 mm.

5. Functional parts of the screw

The screw serves as an additional securing of the plate stability.



6. Instrumentation for the rib plate introduction (Fig. 3)

1. Plate fixation forceps
2. Plate bending forceps
3. Sleeves
4. Drills
5. Holding forceps
6. Screwdriver

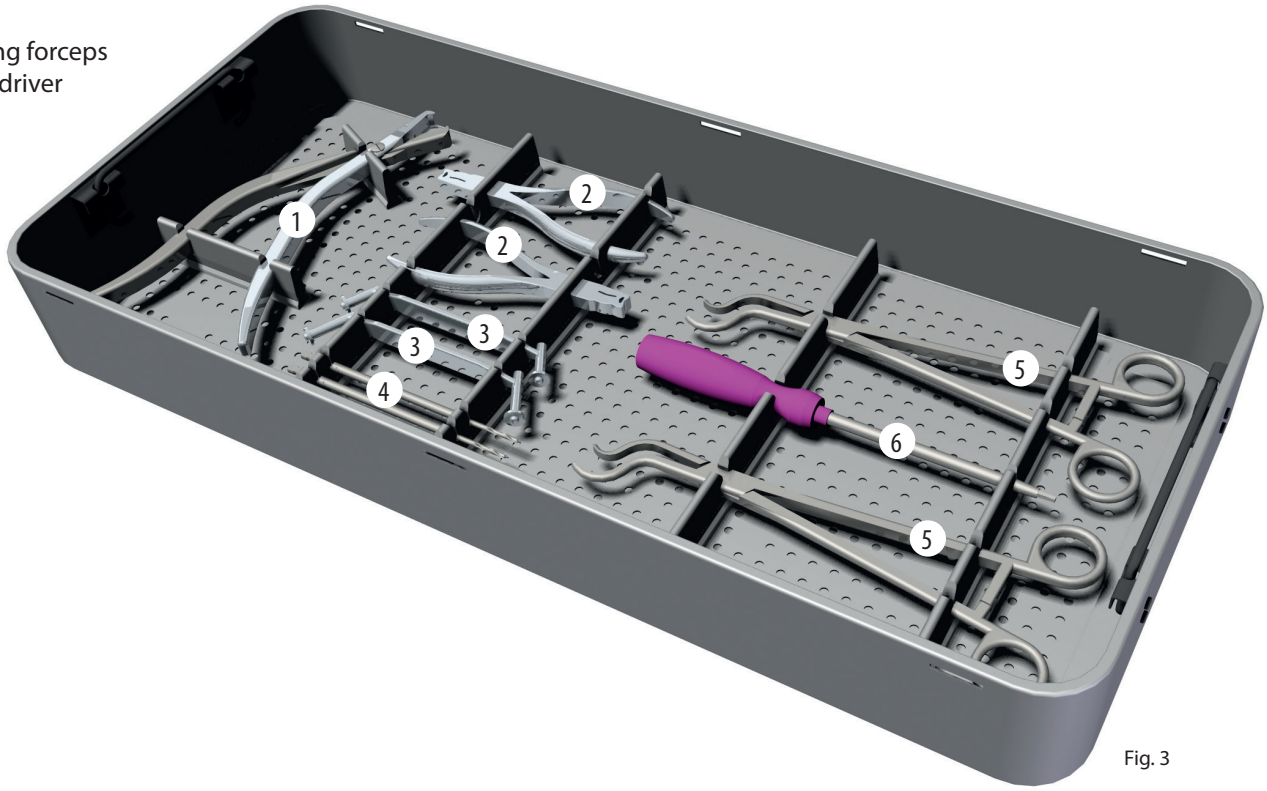


Fig. 3

INSTRUMENTS

1. Plate bending forceps

a) Plate bending forceps (Fig. 4a)

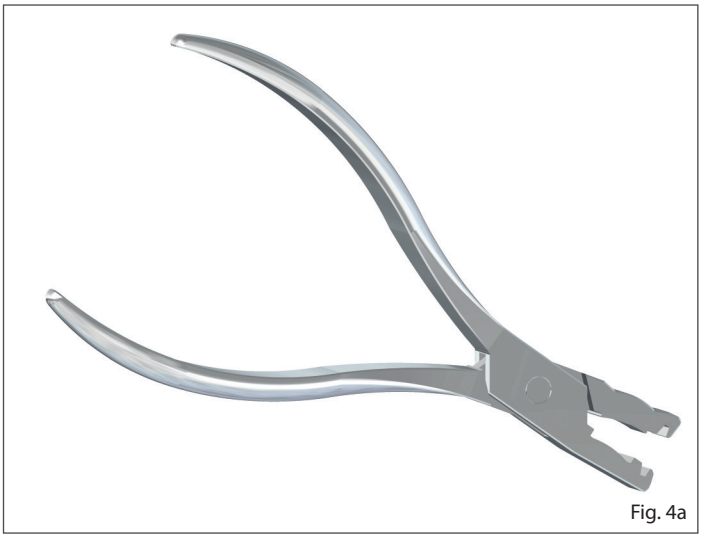


Fig. 4a

b) Functional elements of the plate bending forceps (Fig. 4b)

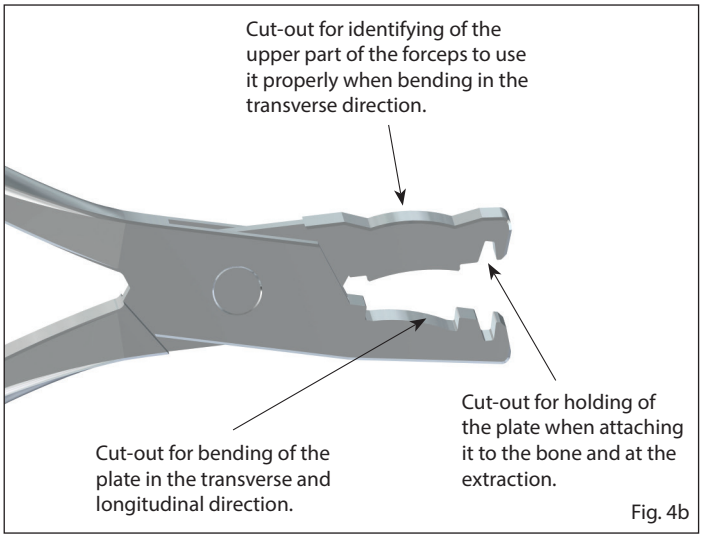


Fig. 4b

c) Function of the plate bending forceps

1. Attaching of the plate to the rib. (obr. 4c)

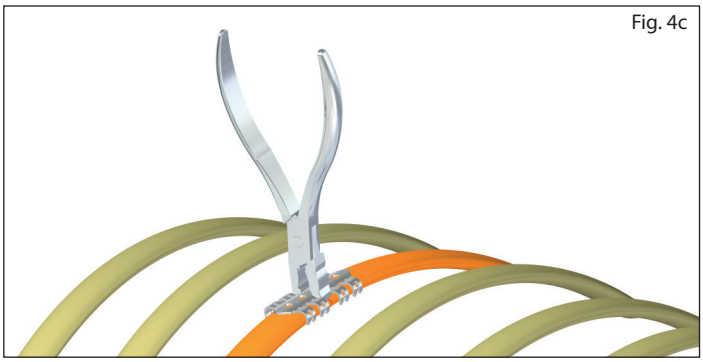


Fig. 4c

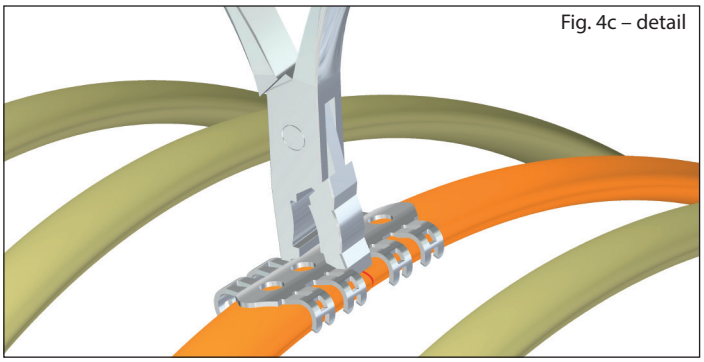


Fig. 4c – detail

2. Bending of the plate in the longitudinal direction. (Fig. 5)

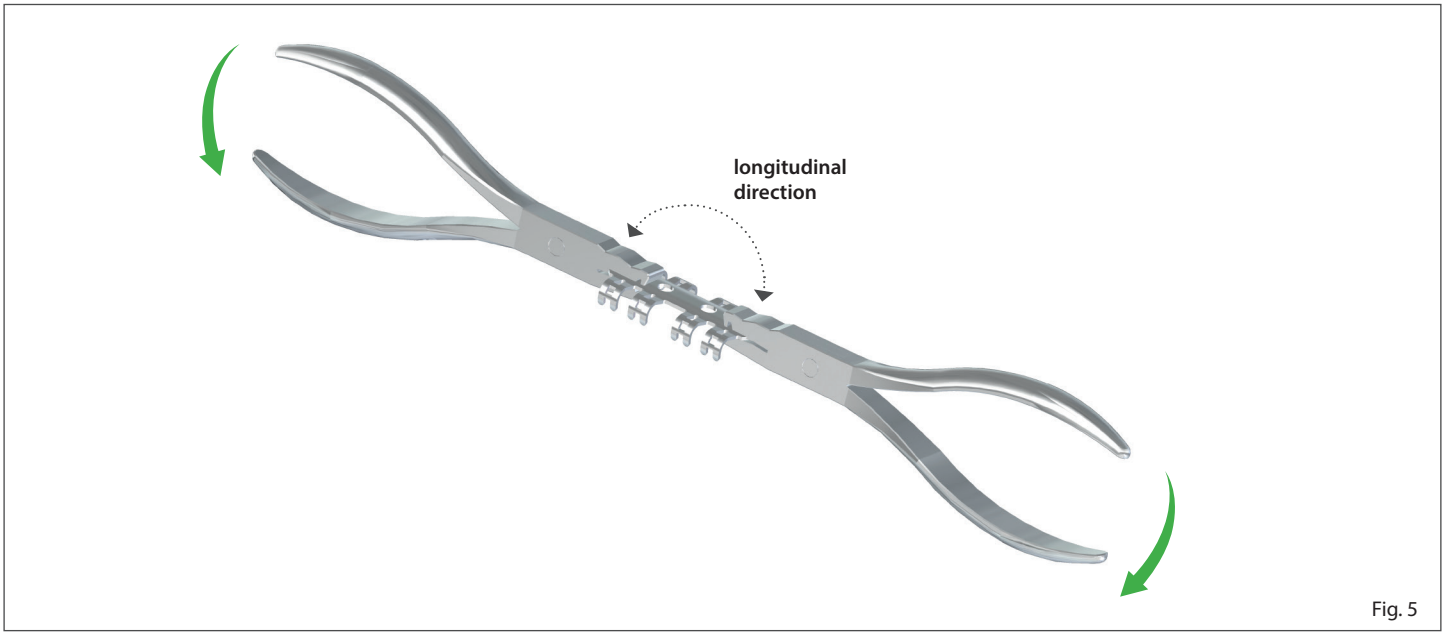


Fig. 5

3. Bending of the plate in the transverse direction. (Fig. 6a)
(only for plates 115/7; 135/8; 155/9 in the location of the drop-like shape)

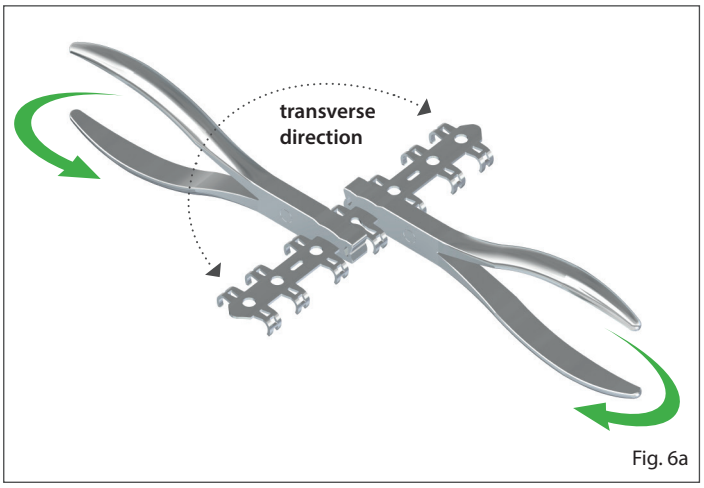


Fig. 6a

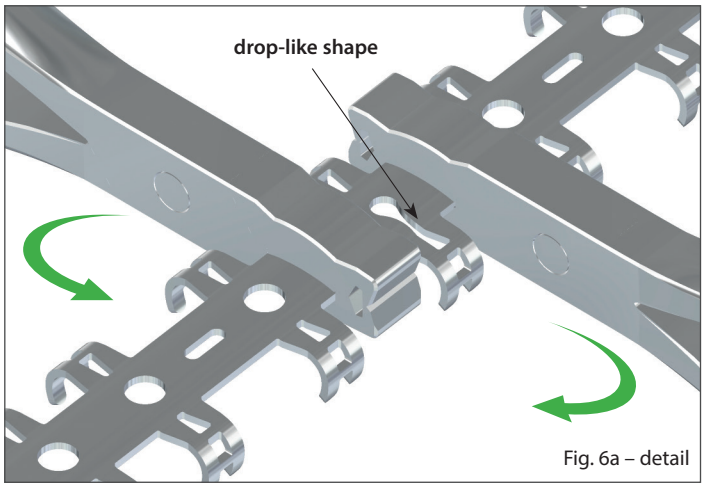


Fig. 6a – detail

When bending the plate correctly a drop-like shape is getting smaller.(Fig. 6b)

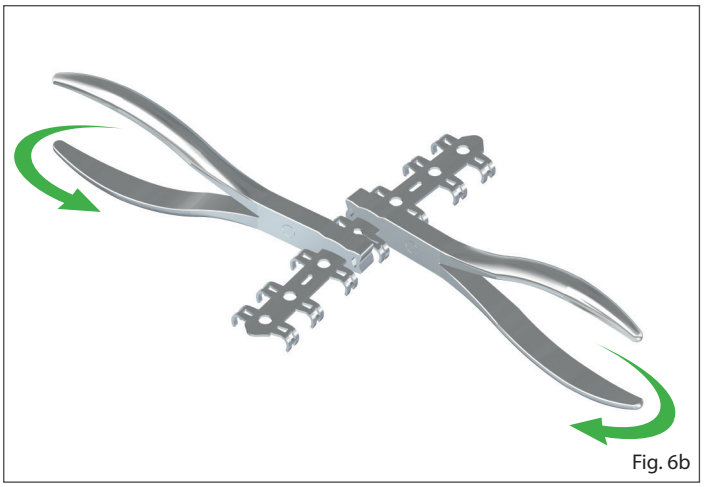


Fig. 6b

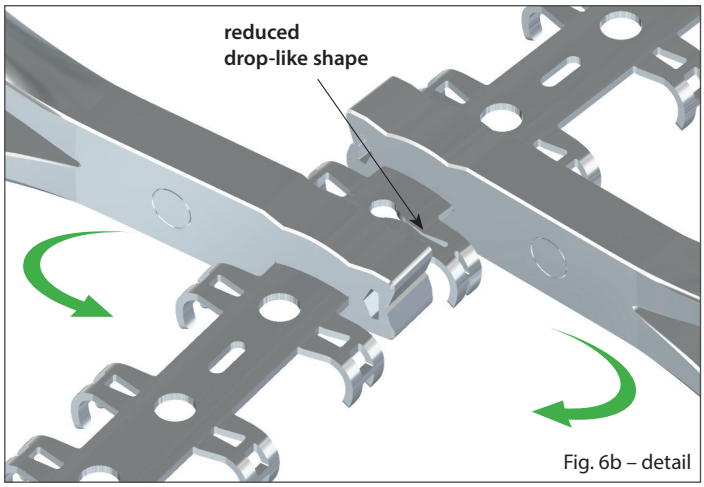


Fig. 6b – detail

2. Holding forceps

a) Holding forceps (Fig. 7a)

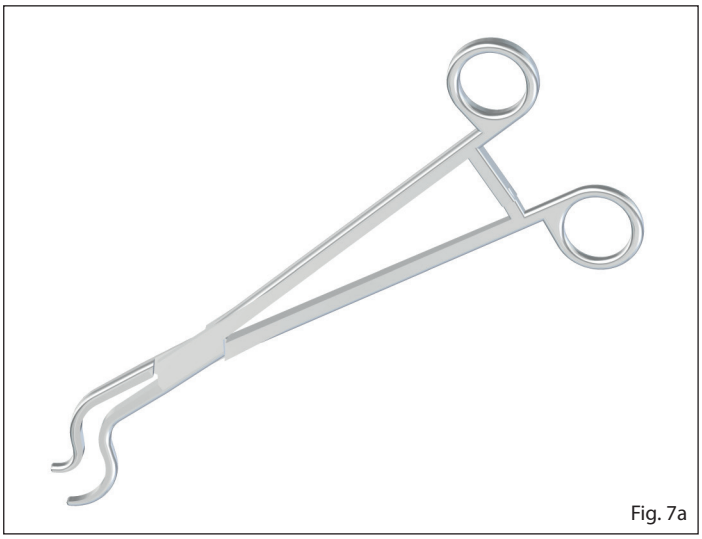
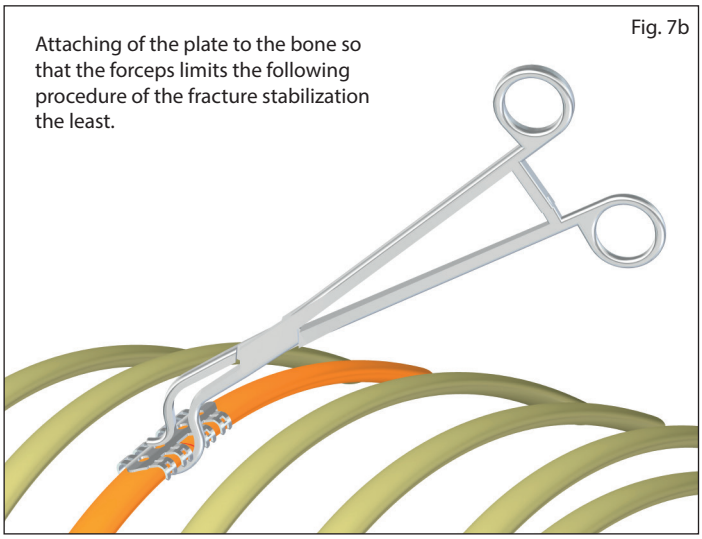


Fig. 7a

b) Function of the holding forceps (Fig. 7b)

Fig. 7b

Attaching of the plate to the bone so that the forceps limits the following procedure of the fracture stabilization the least.



3. Drill of 2.5 mm with a stopper

The stopper serves (Fig. 8) as a safety measure when drilling into the bone through a sleeve. It prevents a patient soft tissue damage.

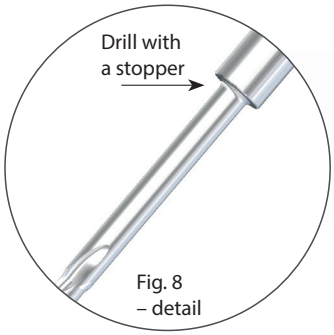


Fig. 8
– detail

Fig. 8

4. Sleeves for drilling of the holes of the different depths

Marking of the sleeves (Fig. 9a, Fig. 9b) serves for a correct selection of the screw length. A sleeve marked by green is always safer than a sleeve marked by red.

Fig. 9a

Fig. 9b

5. Function of the sleeves and drill

System of the drill with stopper and the sleeves. (Fig. 10a, Fig. 10b)

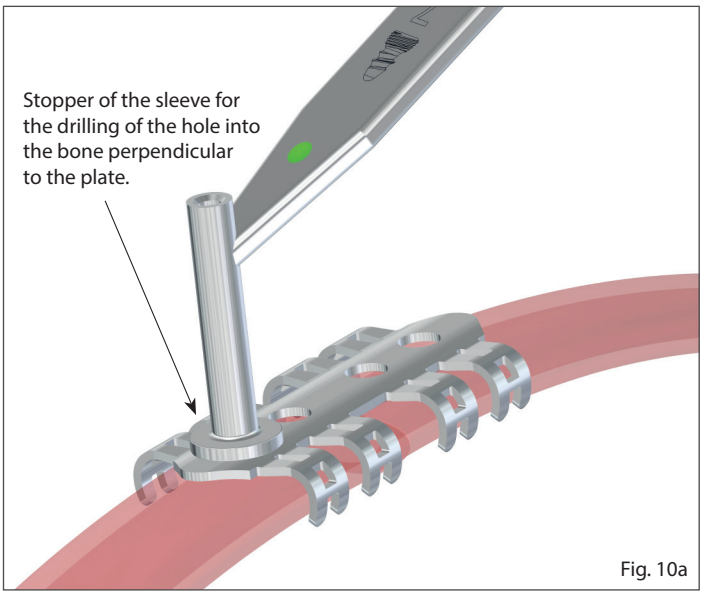


Fig. 10a

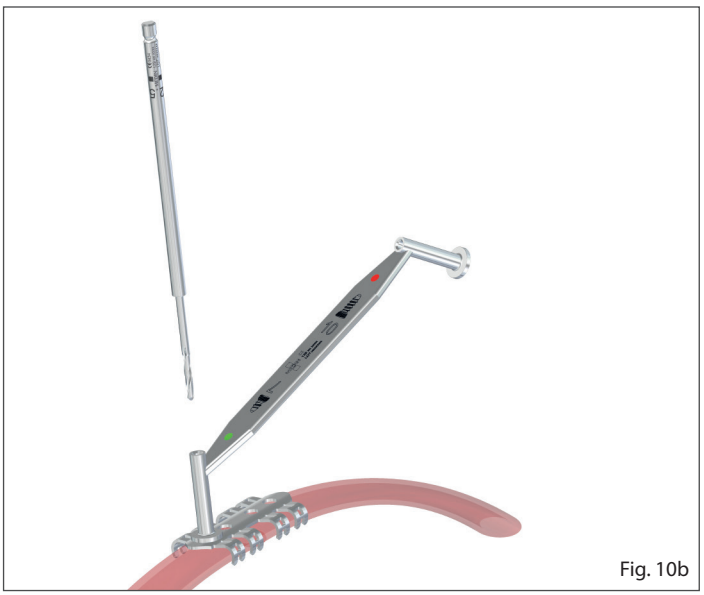


Fig. 10b

Leaning of the drill with stopper against the sleeve 7. Safe drilling only through a frontal corticalis of the rib with the longest sleeve for the shortest screws. (Fig. 11a)

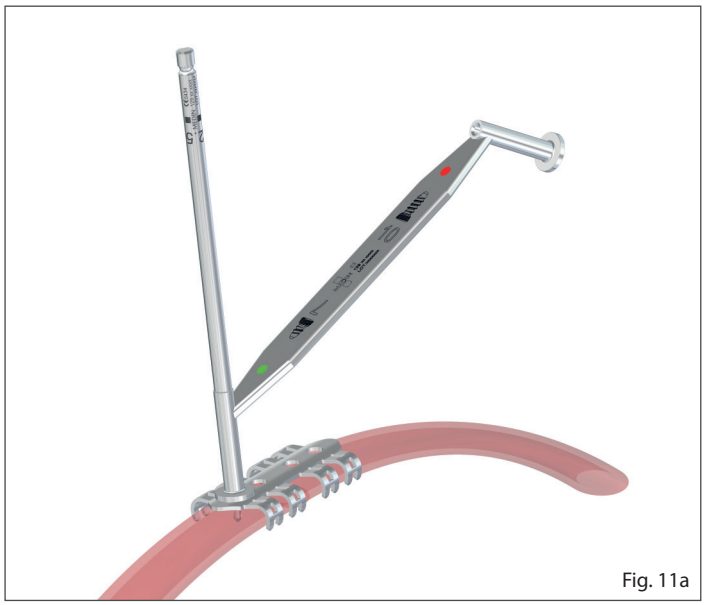


Fig. 11a

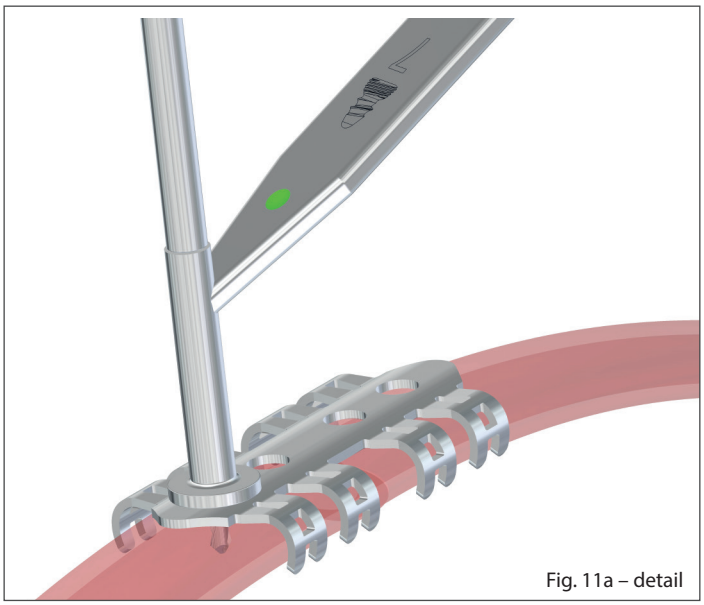


Fig. 11a – detail

Change of sleeve 7 for sleeve 10 for drilling of a deeper hole through both corticales of the rib. (Fig. 12a, Fig. 12b)

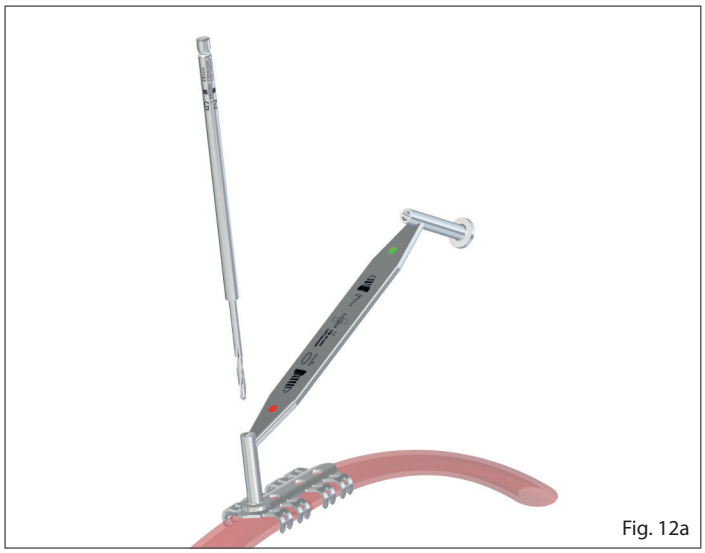


Fig. 12a

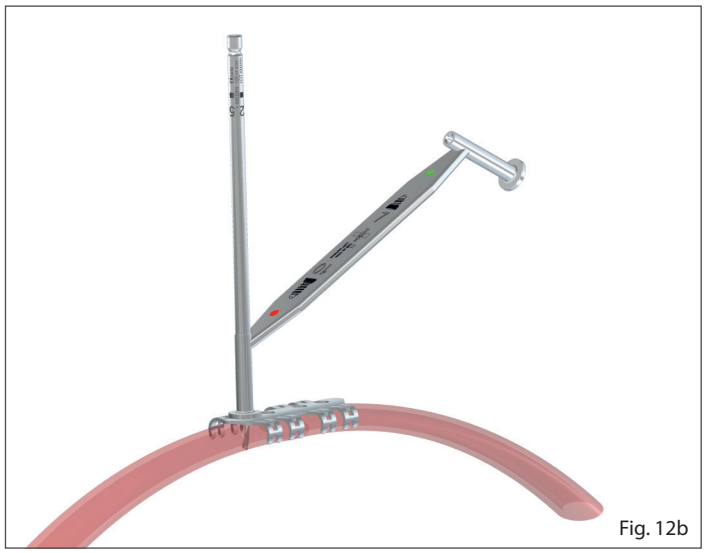


Fig. 12b

Drilling through a frontal corticalis of the rib and leaning of the drill end against a dorsal corticalis of the rib. (Fig. 13a)

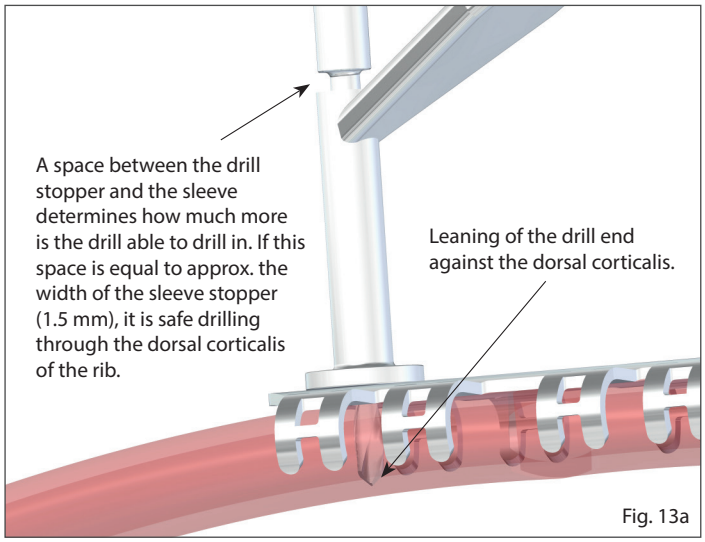


Fig. 13a

Safe drilling through a dorsal corticalis of the rib. (Fig. 13b)

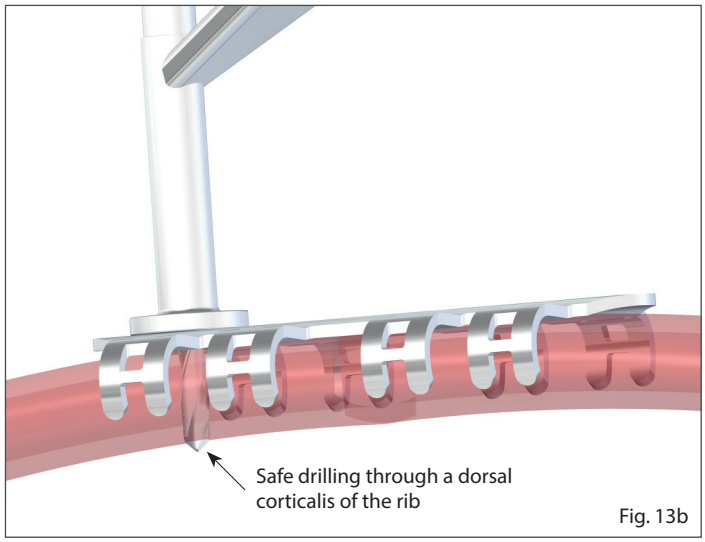


Fig. 13b

Inserting of the screw of the size marked on the sleeve used for drilling, where the drill stopper leans against the sleeve. (Fig. 14a)

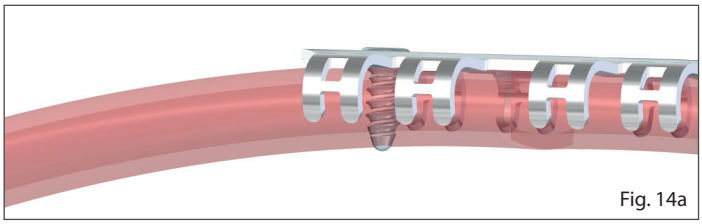


Fig. 14a

It is also safe to use a screw one row longer (i.e. 1mm longer) because its end is rounded. (Fig. 14b)

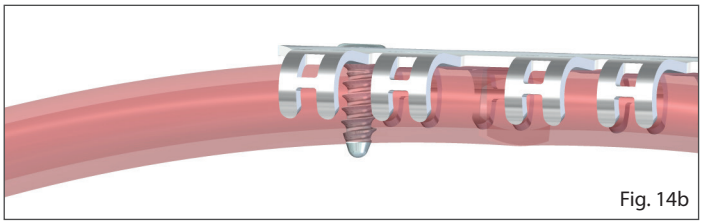


Fig. 14b

A big space is created between the drill stopper and the sleeve when a wrong sleeve (too short) is selected and when a drill end is leaned against the dorsal corticalis of the rib. (Fig. 15a) It is dangerous because the drill can drill through the dorsal corticalis too far when the drill leans against the sleeve (Fig. 15b) and it may cause an injury to the patient.

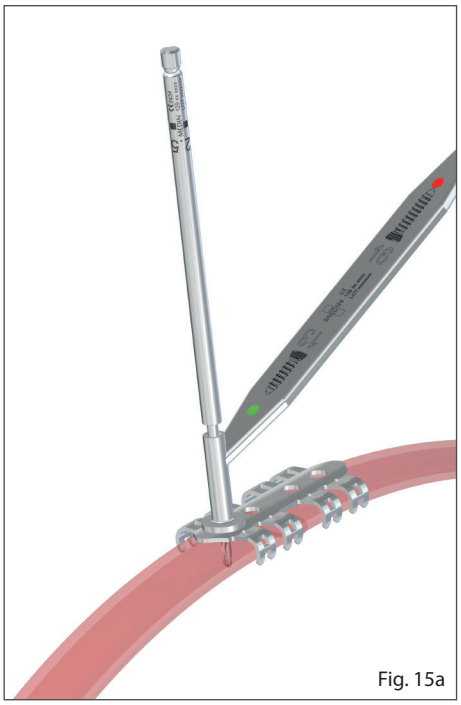


Fig. 15a

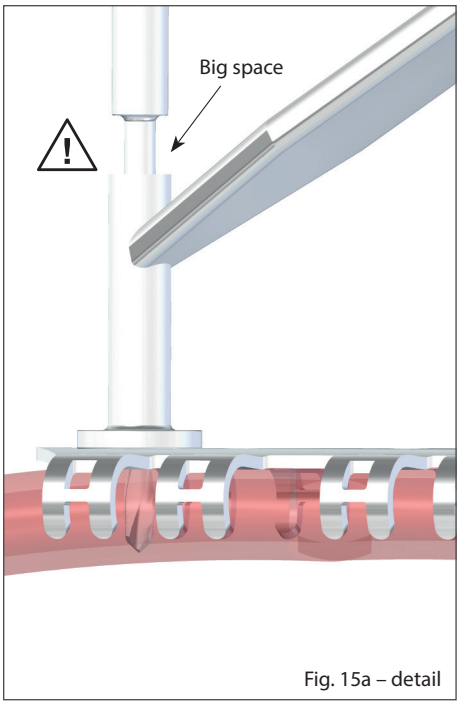


Fig. 15a – detail

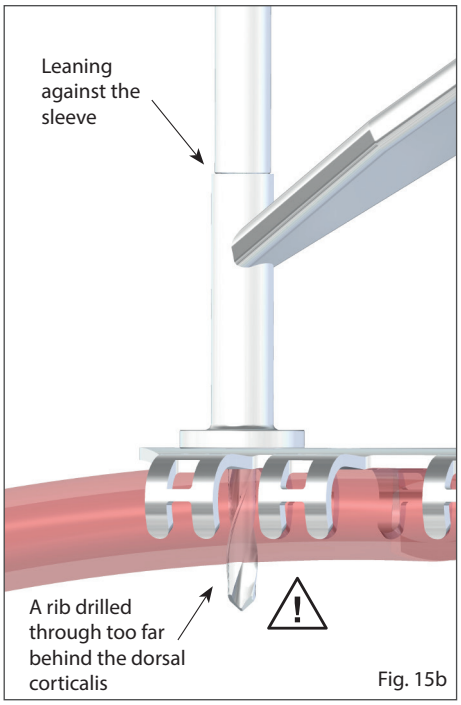


Fig. 15b

6. Screwdriver for screw insertion

The screwdriver ending is adapted to hold the screw on the screwdriver when the screw is transferred to its final place. (Fig. 16a, Fig. 16b)

Fig. 16a

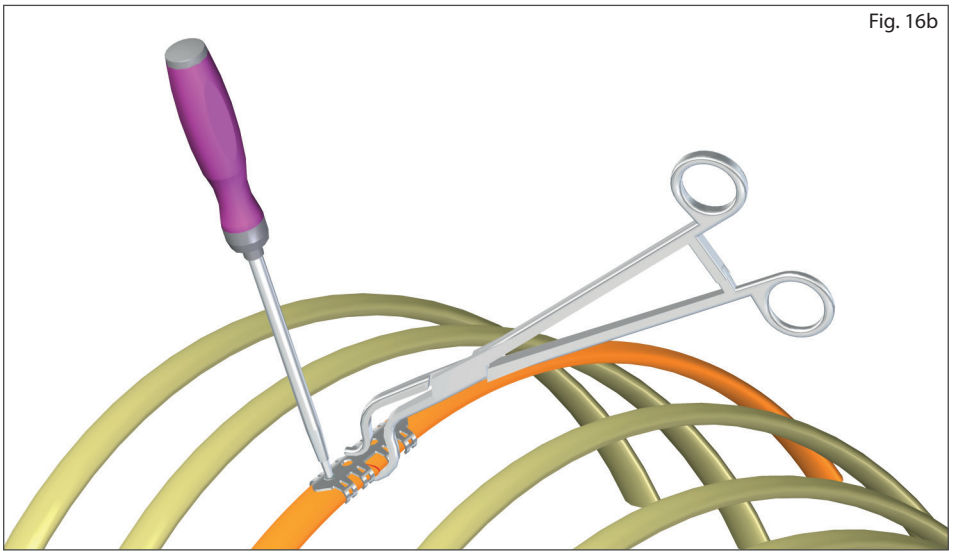


Fig. 16b

7. Plate fixation forceps

Plate fixation forceps are intended for the plate fixation to the rib. The fixation arms of the plate are contouring under the rib by itself without causing any deformation to the rib when the plate is being bended by the forceps (Fig. 17)


Fig. 17

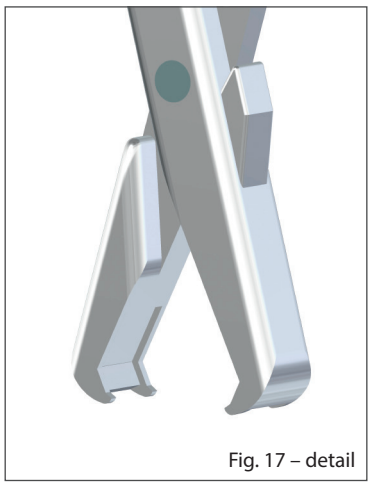


Fig. 17 – detail

Function of the plate fixation forceps

a) The primary both-sided fixation serves for the basic attachment of the plate to the rib using the fixation arms. This fixation is sufficient in many cases and there is no need for the following one-sided fixations from both sides. (Fig. 18)


Fig. 18

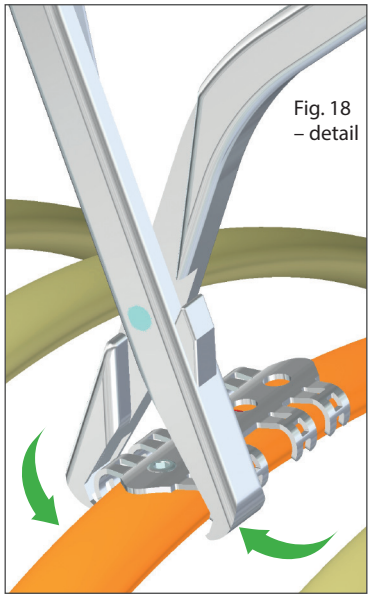


Fig. 18 – detail

b) The secondary one-sided fixation from both sides – one side of the forceps leans with its notches against the plate body and the other side of the forceps bends the fixation arm under the rib. (Fig. 19a, Fig. 19b)

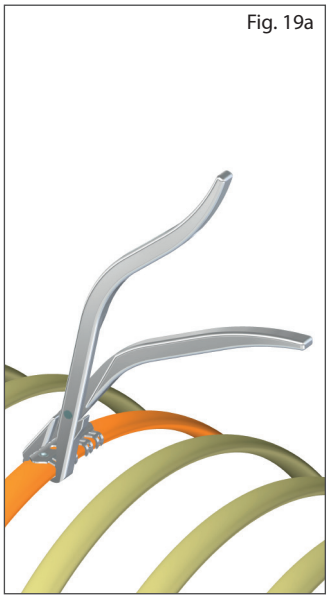


Fig. 19a

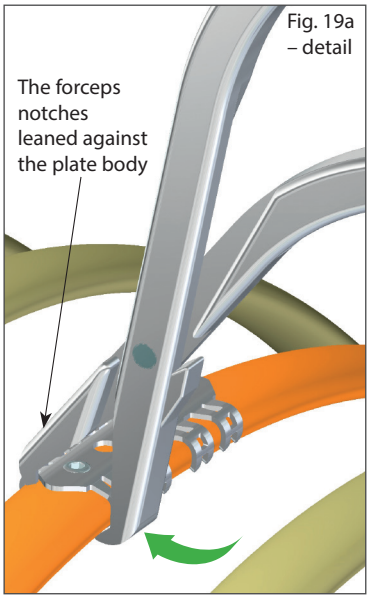


Fig. 19a – detail

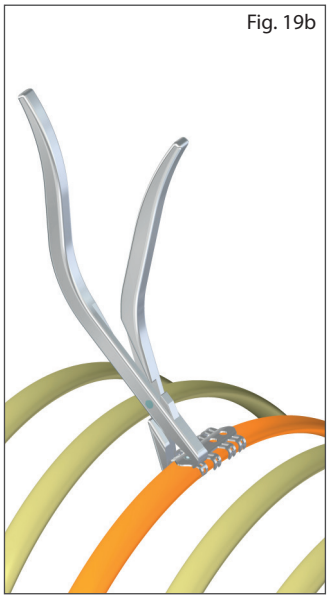


Fig. 19b

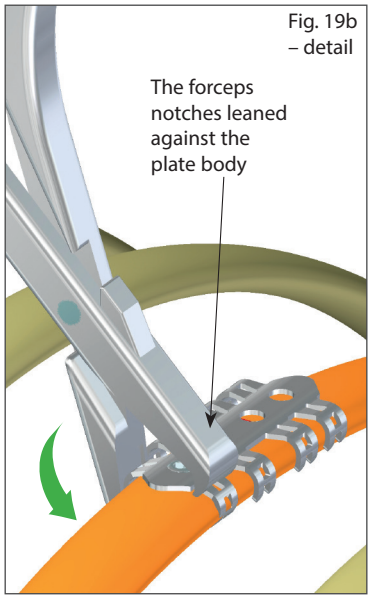


Fig. 19b – detail

NOTE: IT IS RECOMMENDED TO PRIMARY PERFORM THIS ONE-SIDED FIXATION FROM BOTH SIDES AT THE THIN RIBS TO CONTOUR THE PLATE ARMS MORE UNDER THE RIB!

2. CLINICAL PART

The rib osteosynthesis is performed on the injured patient during the general anaesthesia on the operating table based on the indications. The patient position choose according to the localisation of the fractured ribs - on the back for the fractures of the anterolateral segment or on the side for the fractures of the posterolateral segment.

SURGERY

Cut the skin using the oblique incision and after cut through the chest wall muscles the same way as at the thoracotomy. Free the fracture or fragment ends from the intercostal muscles and the intercostal neurovascular bundle. Choose the plate according to the fracture localisation and also the number of the fragments.

1. Simple fracture (Fig. 20a)

A solution using the short plates 40/4 or 55/4 (marking of the plates – length in mm/number of pairs of the fixation arms).
The plate must have a possibility for the strong attachment of two pairs of the fixation arms on both sides of the fracture for stability.

a) Attach the plate to the rib contour (Fig. 20b)**. Check how the plate anatomically contour the rib and bend using the plate bending forceps if necessary.** (Fig. 20c)

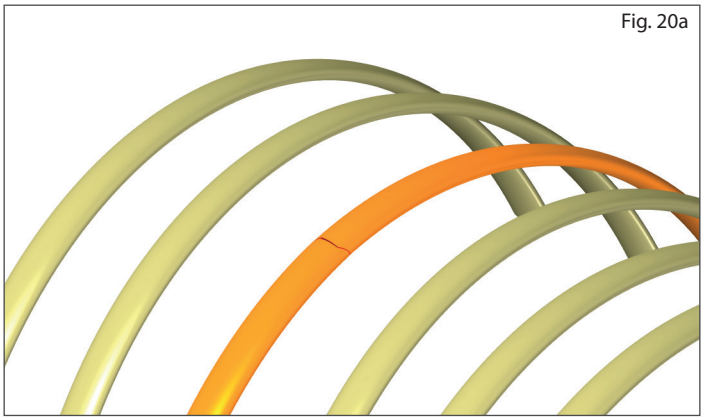


Fig. 20a

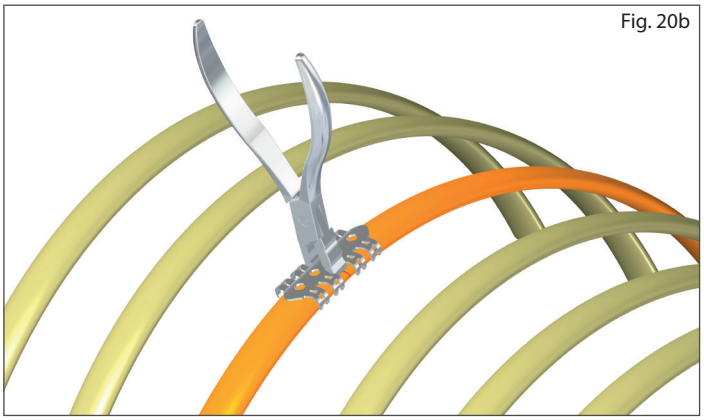


Fig. 20b

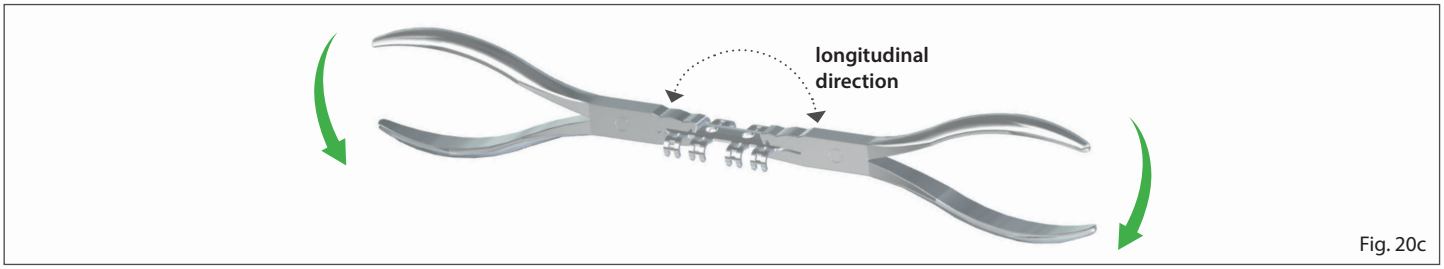


Fig. 20c

b) Put the plate on using the plate bending forceps (obr. 21a) **and attach to the rib contour using the holding forceps on the first fragment.** (obr. 21b)

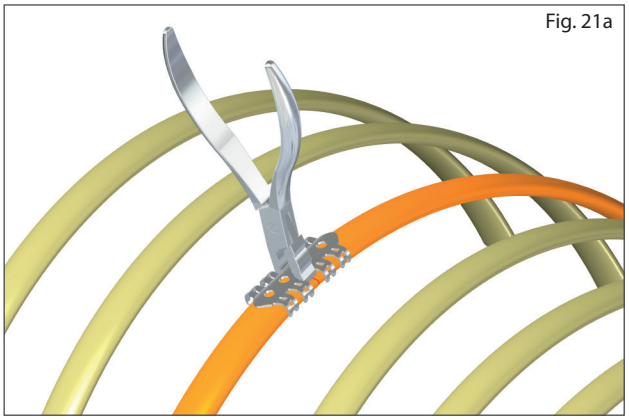


Fig. 21a

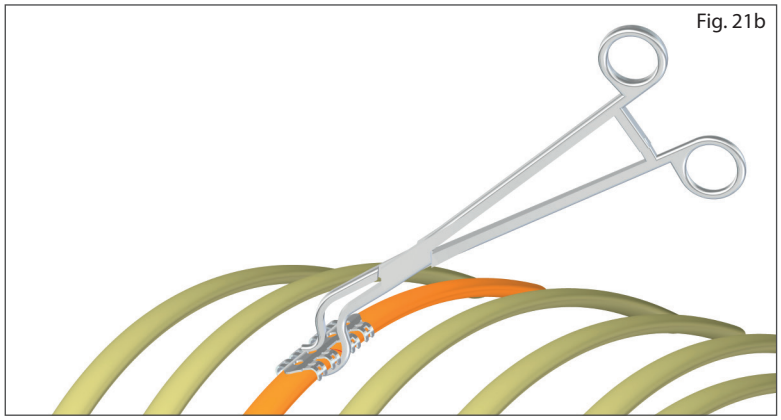


Fig. 21b

c) The sleeve size (7/10/13/16) select according to the expected rib thickness. Put the sleeve to the plate perpendicularly. (obr. 22)

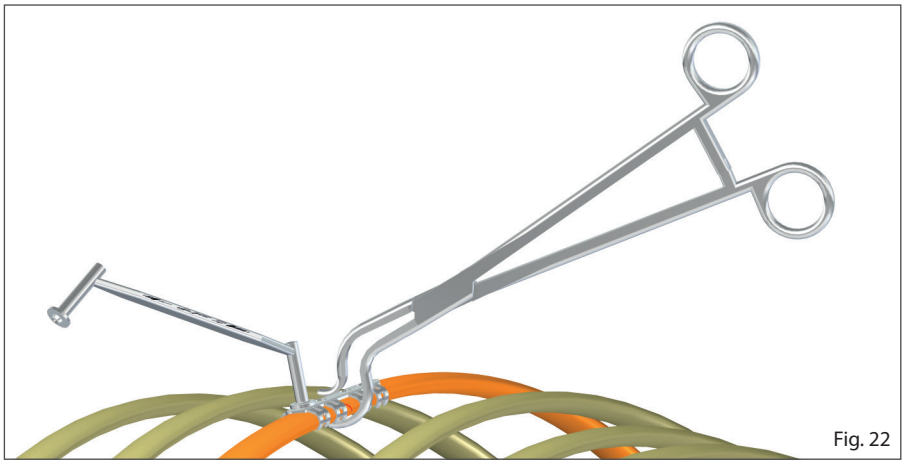


Fig. 22

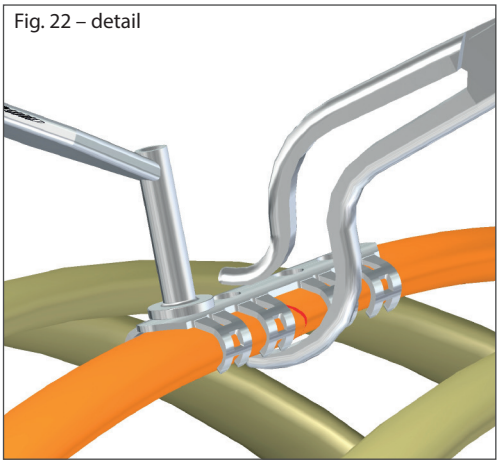


Fig. 22 – detail

d) Drill the hole into the bone in the first fragment (according to the sleeve and drill functions). (obr. 23a, obr. 23b)

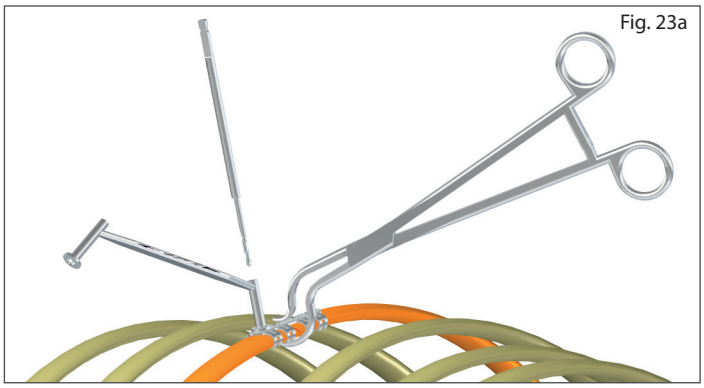


Fig. 23a

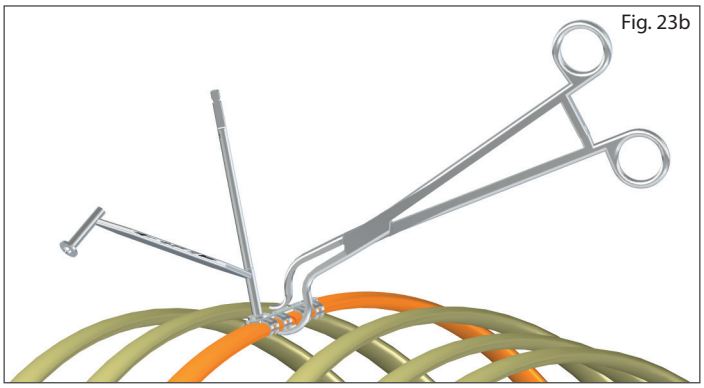


Fig. 23b

e) Safe drilling through both rib corticales when the correct sleeve is selected. (obr. 24)

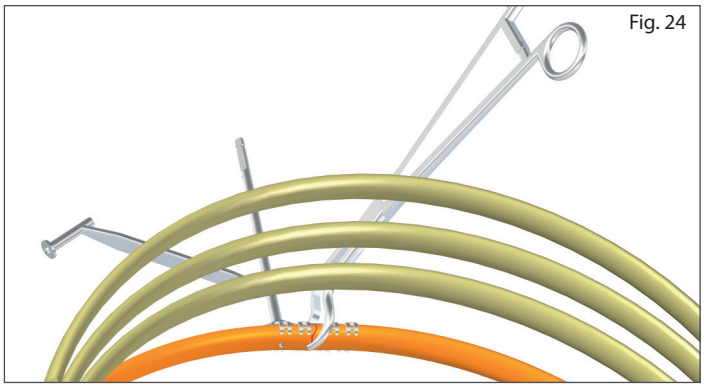


Fig. 24

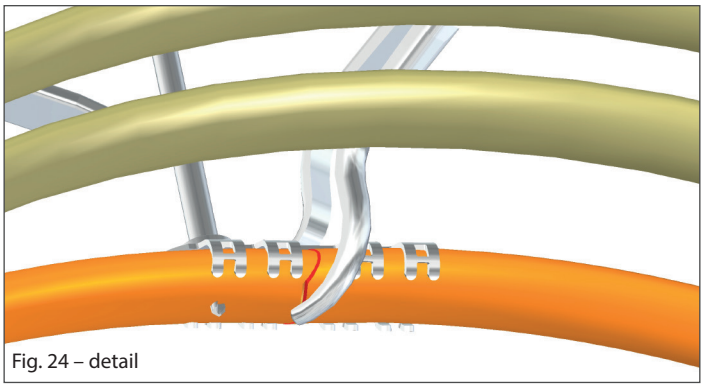


Fig. 24 – detail

f) Use the screws of the size according to the marking on the sleeve which was used for a drilling of the hole (according to the sleeve and drill functions) for a fixation increase. It will minimise a possibility of the patient injury. (obr. 25a, obr. 25b)

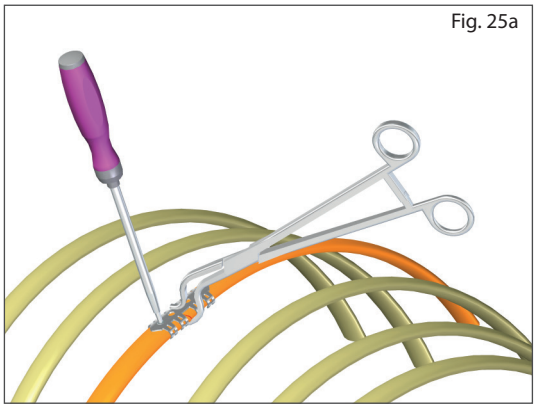


Fig. 25a

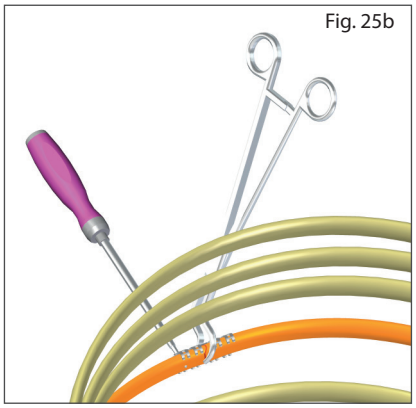


Fig. 25b

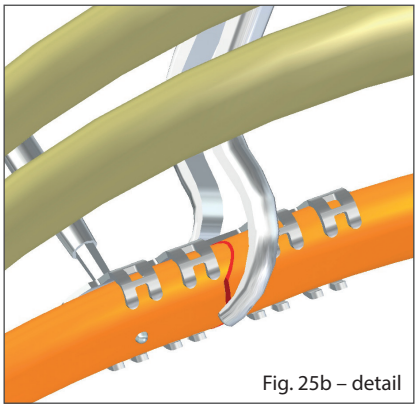
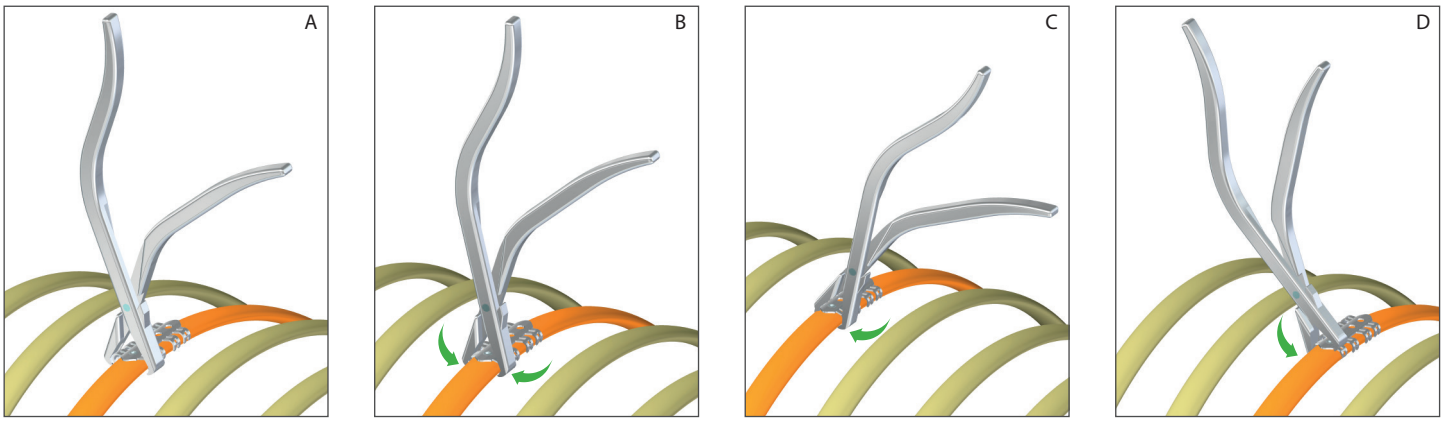


Fig. 25b – detail

g) Attach the fixation arms of the plate to the bone on the first fragment using the fixation forceps (according to the fixation forceps function).



h) Perform a reposition and a following fixation similarly onto the second fragment too - drill the hole for the screw using the drill and sleeve and attach the plate fixation arms to the bone using the fixation forceps (according to the fixation forceps function). (obr. 26)

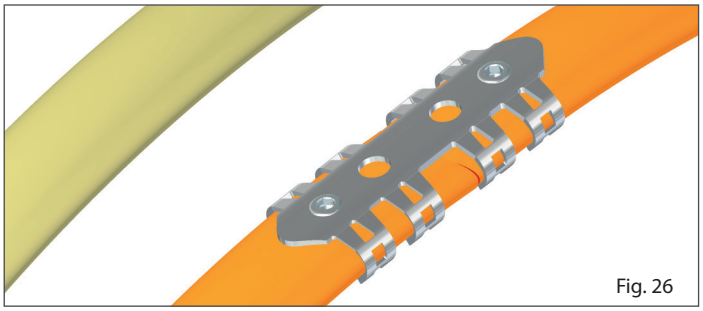


Fig. 26

i) Possibility of the screw fixation in all plate holes. (Fig. 27a, Fig. 27b)

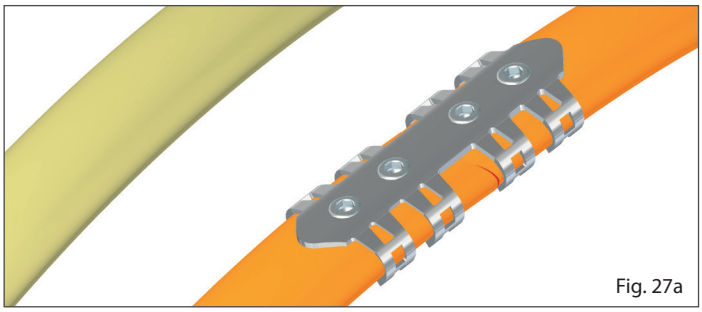


Fig. 27a

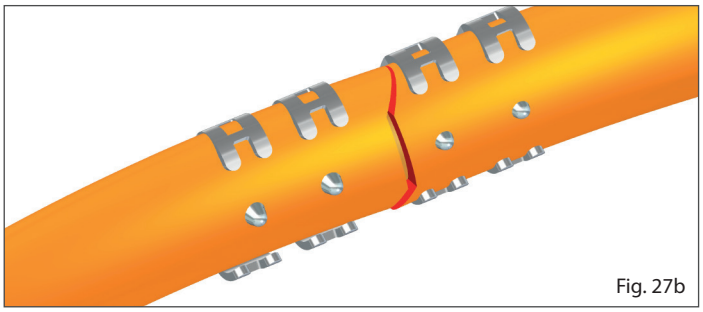


Fig. 27b

j) It is possible to use only attachment of the plate to the rib using only the fixation arms in some cases. This method is more gentle to the tissues under the rib because it does not use a holding forceps. However this method needs higher attention and precision at the plate fixation.
Hold the plate using the plate bending forceps and afterwards press the fixation arms on the first fragment with the plate fixation forceps. Perform the reposition and press the fixation arms on the second fragment using the fixation forceps. (Fig. 28a, Fig. 28b)**. If the plate does not move and it is sufficiently fixed to the bone, the fixation with the screws is not necessary, in the other case drill the holes for the screws using a drill and sleeves and ensure the plate with the screws (according to the sleeve and drill function).**

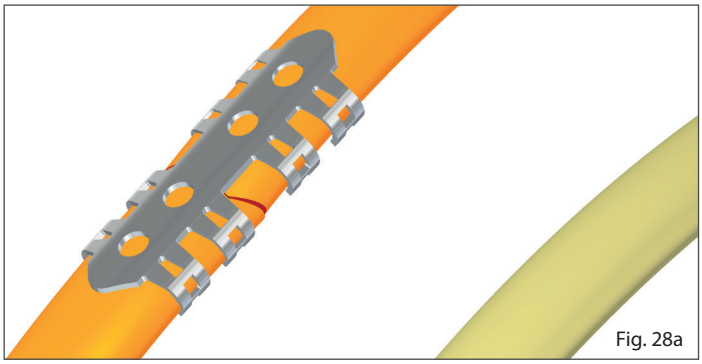


Fig. 28a

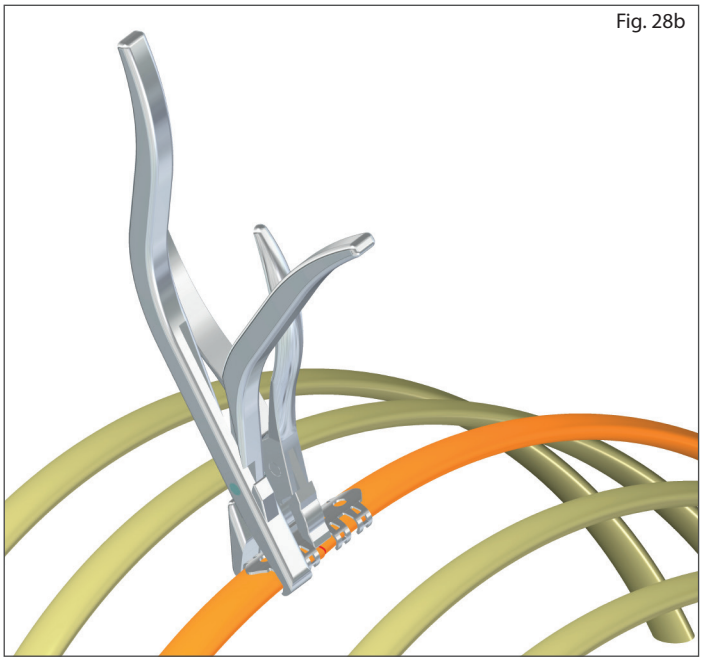


Fig. 28b

2. Fracture with one loose fragment from 70 mm

Solution using two plates 40/4; 55/4 – introduce according to the simple fracture description. (Fig. 29a, Fig. 29b)

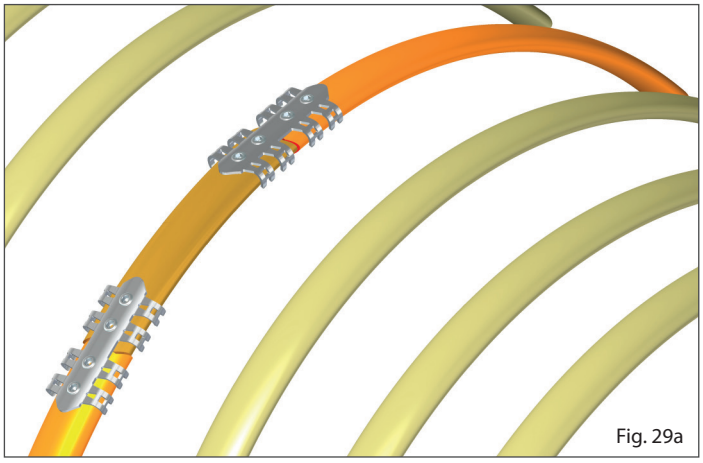


Fig. 29a

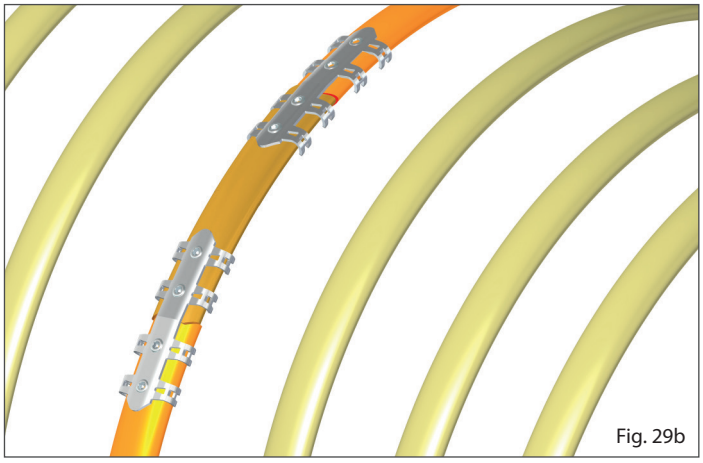


Fig. 29b

3. Fracture with one loose fragment up to 100 mm

Solution using the plates 75/5; 95/6; 115/7; 135/8; 155/9 – introduce according to the simple fracture description. (Fig. 30a)

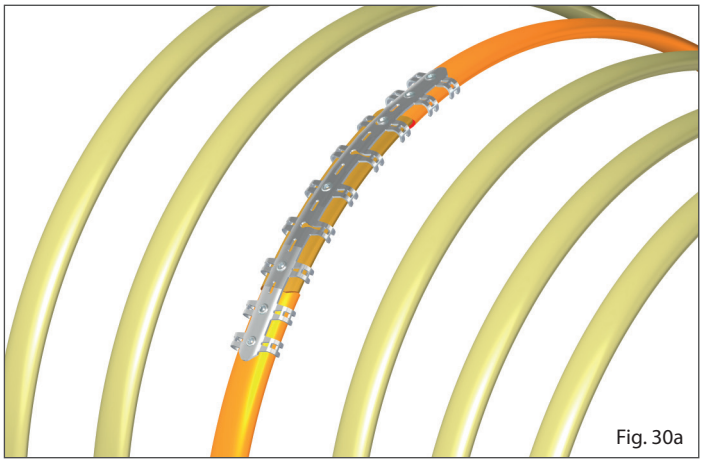


Fig. 30a

The plates 115/7; 135/8; 155/9 are also possible to bend in the transverse direction for better contouring according to the rib shape using the plate bending forceps (see the plate bending forceps function). (Fig. 30b)

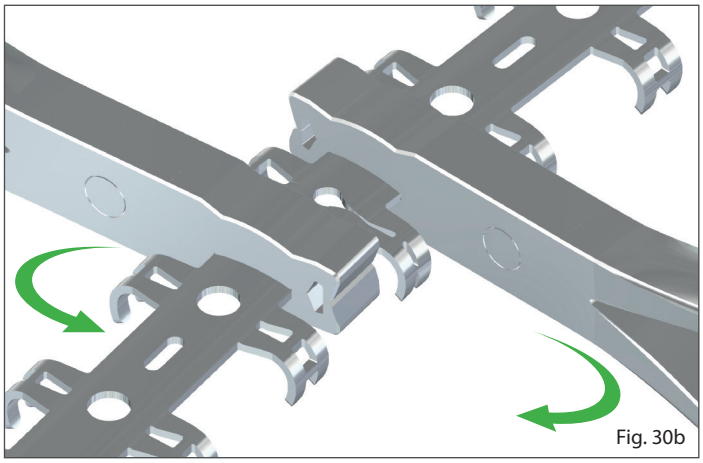


Fig. 30b

4. Fracture with the loose fragments in a row up to 100 mm

Solution using the plates 75/5; 95/6; 115/7; 135/8; 155/9 – introduce according to the simple fracture description. (Fig. 31a)

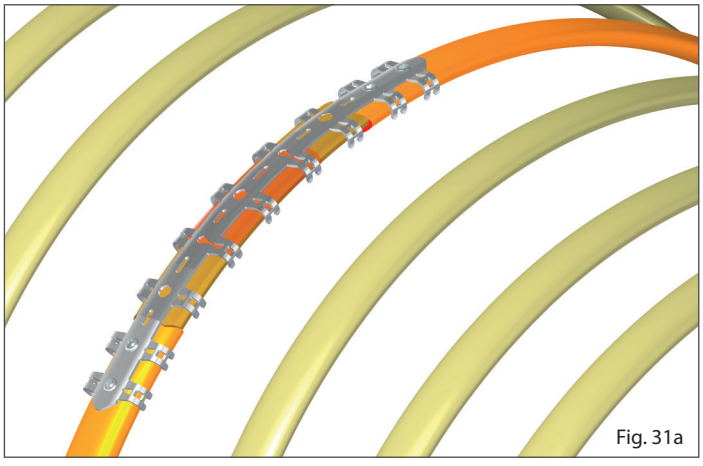


Fig. 31a

The plates 115/7; 135/8; 155/9 are also possible to bend in the transverse direction for better contouring according to the rib shape using the plate bending forceps (see the plate bending forceps function). (Fig. 31b).

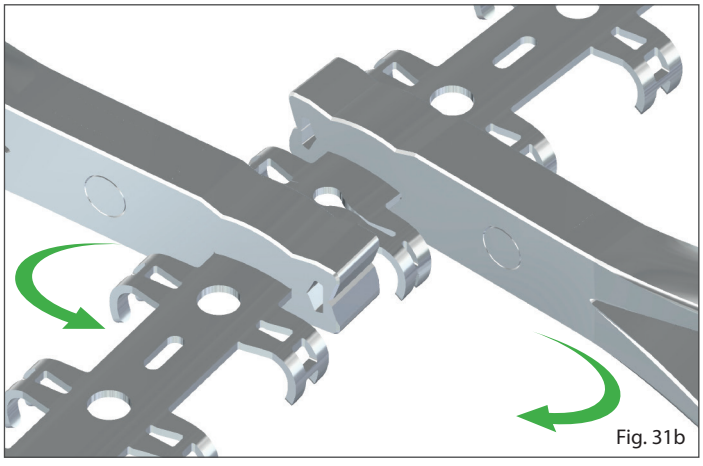


Fig. 31b

OSTEOSYNTHESIS COMPLETION

Check the osteosynthesis firmness and always introduce a chest drain into the pleural space, because a rib fracture connects not only with a rupture of the intercostal muscles but also with a damage of the parietal pleura. Start the rib osteosynthesis after the treatment of an intrathoracic complication (laceration, lung tear) in the case of the lung damage. Perform the sutures in the anatomical layers. It is necessary to use a temporary drainage in the case of a bigger haematoma in the chest wall, preferably with a Redon drain.

PLATE EXTRACTION

We grasp the plate using the plate bending forceps as close as possible to the fixation arm which should be loosened after unscrewing of the screws (Fig. 32a). The plate bending forceps mainly eliminates the force caused by the loosening. Grasp the fixation arm with the end notches of the plate fixation forceps and pry against the plate bending forceps (Fig. 32b, Fig. 32c).

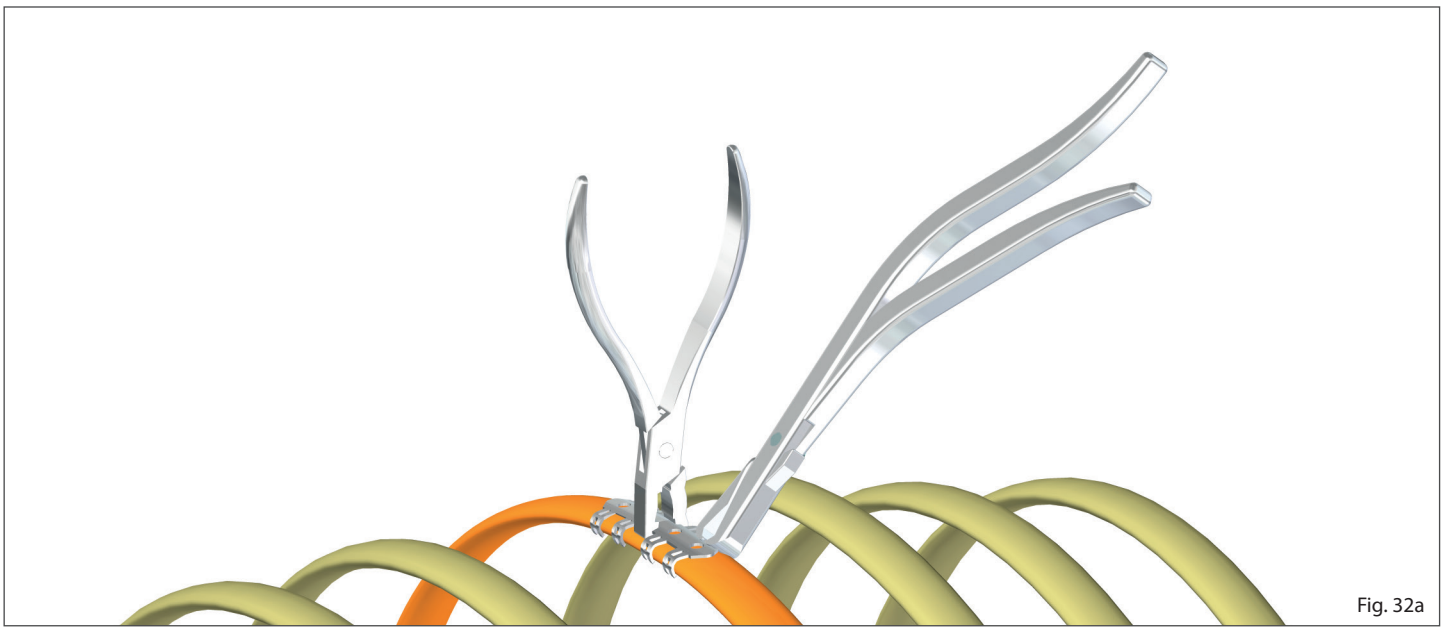


Fig. 32a

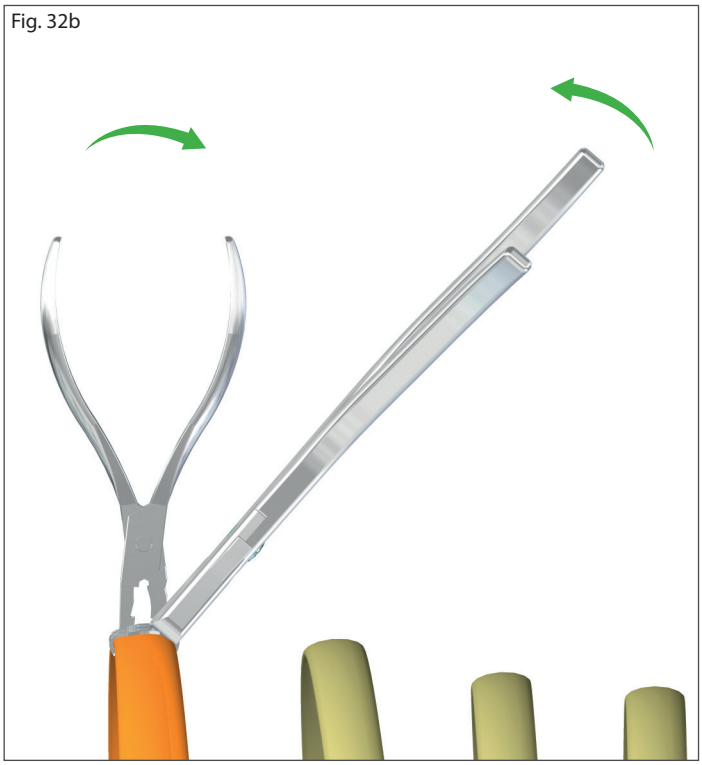
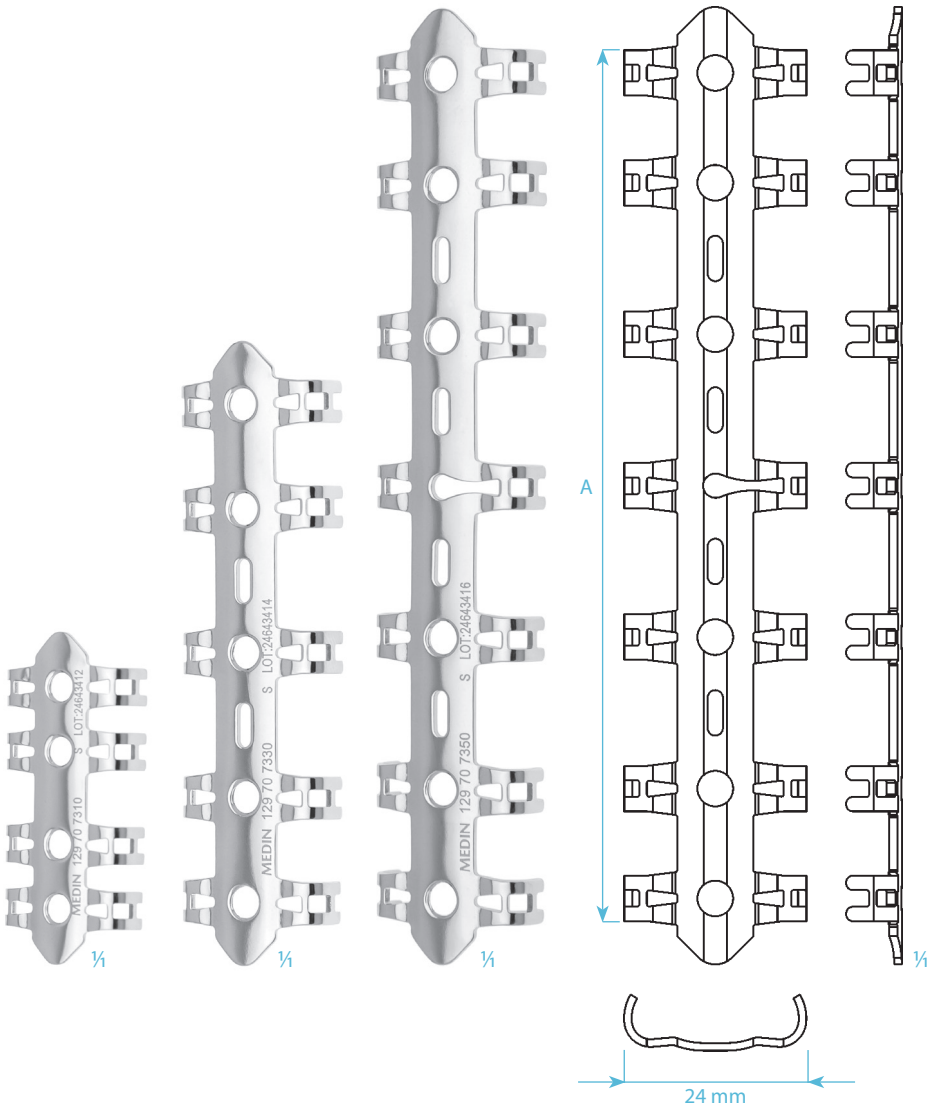


Fig. 32b

Fig. 32c

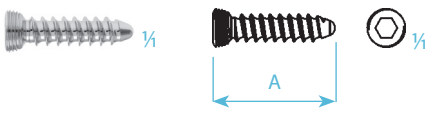


Rib plate

SSt	A	počet otvorů holes
397 129 70 7310	40 mm	4
397 129 70 7320	55 mm	4
397 129 70 7330	75 mm	5
397 129 70 7340	95 mm	6
397 129 70 7350	115 mm	7
397 129 70 7360	135 mm	8
397 129 70 7370	155 mm	9

plate thickness 1 mm

SCREWS:
cortical locking screw 3.5

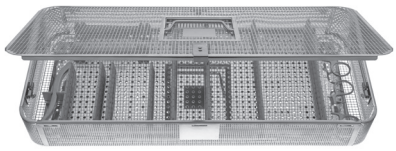


thread diameter	3.5 mm
core diameter	2.5 mm
head diameter	5.0 mm
drill bit for threaded hole	Ø 2.5 mm
screwdriver	⬡ 2.5 mm

Cortical locking screw

SSt	A
397 129 70 7400	7 mm
397 129 70 7410	8 mm
397 129 70 7420	9 mm
397 129 70 7430	10 mm
397 129 70 7440	11 mm
397 129 70 7450	12 mm
397 129 70 7460	13 mm
397 129 70 7470	14 mm
397 129 70 7480	15 mm
397 129 70 7490	16 mm

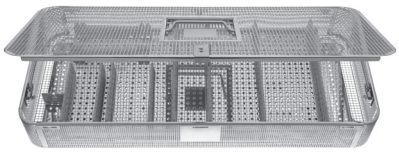
INSTRUMENTS FOR RIB PLATES



397 139 09 0875 Instruments for rib plates
540 × 240 × 70 mm
including instruments, stand for screws and sieve for rib plates
excluding implants

1 2 3 4 5 6 7

397 139 09 0870		soubor	set ks/pcs
1	**397 117 06 0030**	Forceps for the plate fixation, fixing	1
2	**397 117 08 3220**	Forceps for the plate fixation, holding	2
3	**397 117 06 0040**	Forceps for the plate fixation, shaping	2
4	**397 129 68 0060**	Sleeve 7/10	1
5	**397 129 68 0070**	Sleeve 13/16	1
6	**397 129 68 0050**	Drill D2.5 × 35 mm	3
7	**397 129 68 0360**	Screwdriver 2.5 × 200 mm; hexagon	1



397 129 68 0170 Sieve for instruments for rib plates
540 × 240 × 70 mm
including stand for screws and sieve for plates
excluding instruments and implants

397 129 68 0080 Stand for the locking cortical screws 3.5 mm
110 × 70 × 22 mm
excluding implants

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