

# The Contoured Anterior Spinal Plate

## A Nursing Perspective

By Ellen Atwill, R.N. & Cathy Bustard, R.N.

The Contoured Anterior Spinal Plate (CASP) system was developed by Dr. G. Armstrong (Chief of Orthopaedic Surgery, Ottawa Civic Hospital) with the help of the National Research Council of Canada for anterior stabilization of the thoracolumbar spine. The plates are designed with a contoured fit to accommodate the curvature of the vertebral bodies. Multiple screw holes allow at least three screws per vertebra.

Existing bone plates were inadequate due to the fact that they were too narrow and did not allow for multiple screw fixation<sup>(4)</sup>. Previous attempts had a high failure rate in respect to improving symptoms. Vascular complications were also a problem due to the bulky devices being in close proximity of major blood vessels. After anterior decompression previous spinal stabilizations required a second posterior instrumentation procedure.

The CASP plates have been designed with tapered ends to accommodate the common iliac vessels when working at the lumbar five level. The recently developed thoracic plates have a contoured profile to accommodate the thoracic kyphosis. The plates are made of 316 LVM stainless steel. Plate sizes range from lumbar 9-24 hole and thoracic 11-28 hole.

A drill guide was developed to avoid complications such as vascular injury, canal penetration, angulation of screws, and perforation of the surgical glove<sup>(2)</sup>. The tip of the drill sleeve is designed to fit into the holes of the CASP plate while a C contour with a recessed tip fits around the vertebral body and stops the drill from advancing further. A depth gauge has also been designed for use with the guide to allow screw length measurement with the guide in place.

Originally AO cancellous screws were used, eventually fully threaded AO screws were implemented. Since then CASP screws were developed which have an inner core of 4 mm and an outer diameter of 6.7 mm

thereby increasing the amount of metal by 50%. Rather than having a sharp tip the screws have been designed with a blunt nose. This eliminates any damage that might be caused by a screw that is too long and penetrates past the vertebral body. The screws range in size from 27.5 mm to 70 mm in 2.5 increments.

The CASP instrumentation set is completed with a drill guide, tap guide, tap, screwdriver, 3.5 and 4.5 mm drill bit. (See Fig 1).

### Indications and Contraindications

The system is suitable for stabilizing the following conditions:

- 1 - Anterior decompression and bone grafting of burst fractures. (Fig 2 A & B)
- 2 - Vertebrectomy and cement replacement of vertebra, to increase comfort and mobility of tumour patients. (Fig 3 A,B,C,D,E)
- 3 - Pseudarthrosis.
- 4 - Multiple posterior spine procedures with non union where an anterior interbody fusion might be indicated.
- 5 - Severe disc degeneration.

The plate is contraindicated where there is poor bone quality as in: (i) overt infection, (ii) severe osteoporosis, and (iii) widely disseminated metastatic tumours to multiple adjacent vertebral bodies.

### Authors:

Ellen Atwill is Charge Nurse, Orthopaedic Operating Room, Ottawa Civic Hospital. She received her diploma in nursing from Ottawa Civic Hospital School of Nursing, Ottawa, Ontario.

Cathy Bustard is Charge Nurse, Orthopaedic Operating Room, Ottawa Civic Hospital. She received her diploma in nursing from Halifax Infirmary School of Nursing, Halifax, Nova Scotia.

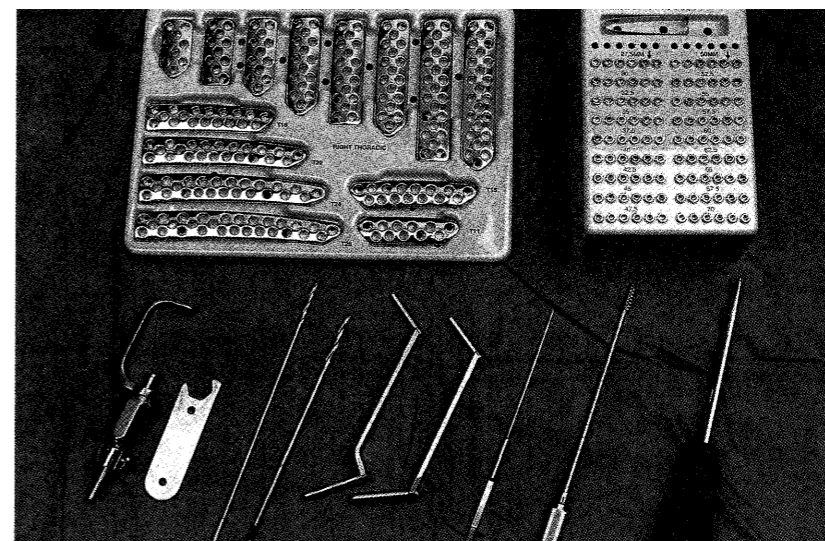


Fig. 1 - CASP plates, screws and instruments

Fig. 2A - Pre-op lateral view burst fracture (T12 - L2) Fig. 2B - Post-op AP view of burst fracture treated with a CASP plate and fibular strut graft

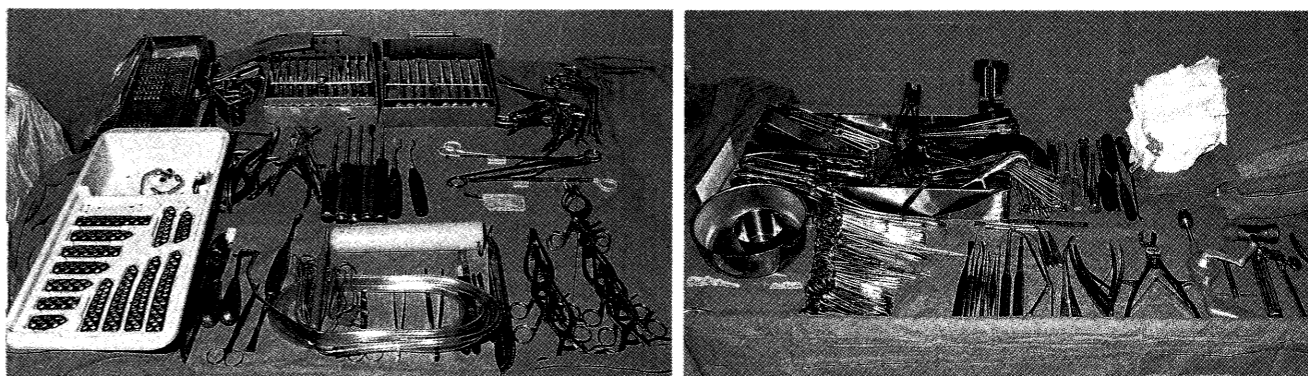
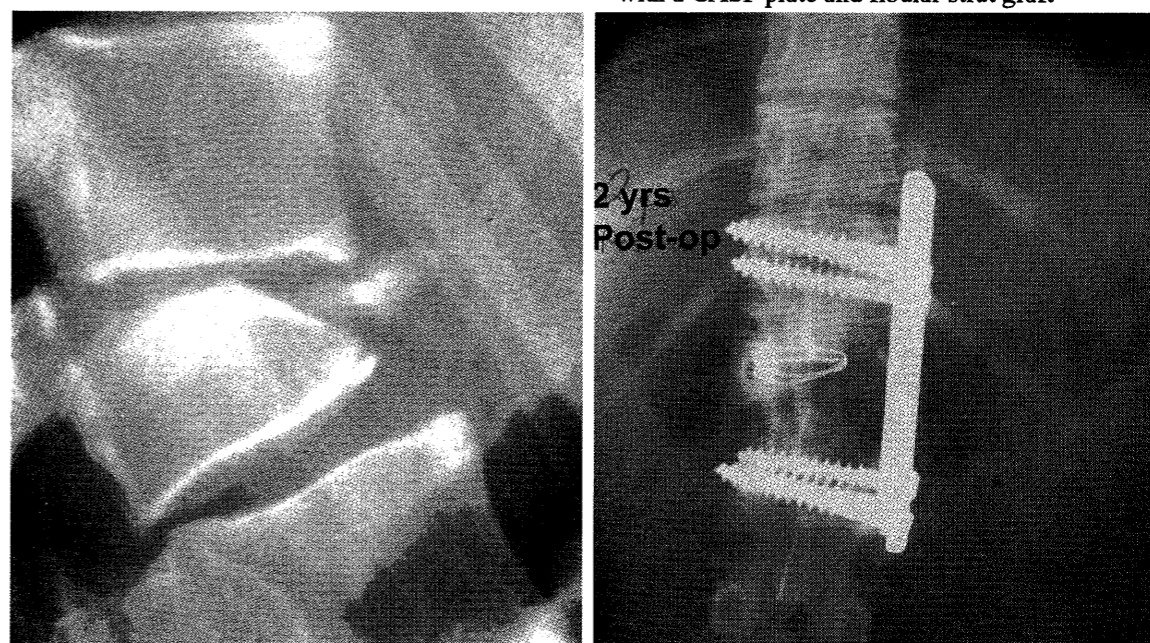


Fig. 4A - Basic spinal Mayfield table with CASP plates

Fig. 4B - Back table of basic spinal instruments

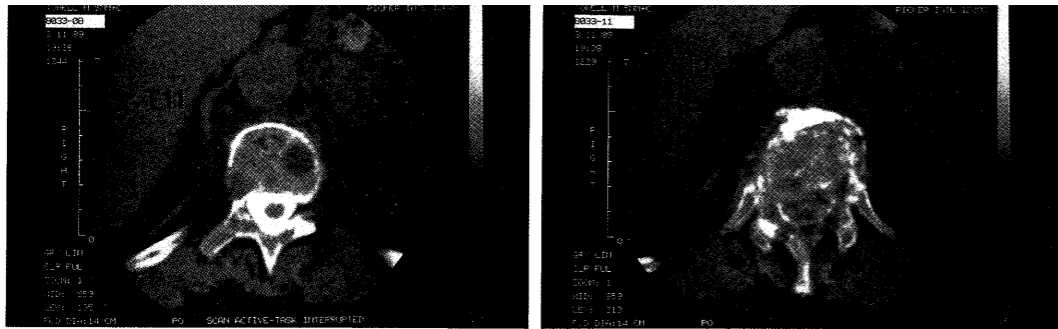


Fig. 3A & B - CT scan - metastatic breast cancer with secondary at T11 - T12



Fig. 3C - Complete block of T11-T12 as demonstrated on myelogram

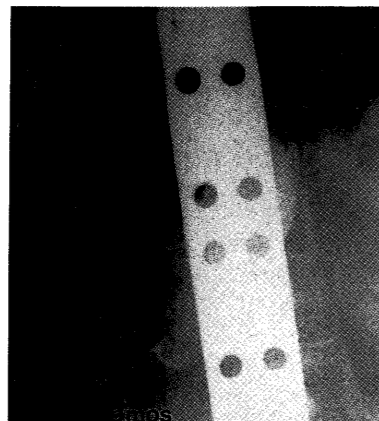


Fig. 3D - Post-op lateral treated with CASP plate, T10-L2 fusion with a bone/cement spacer

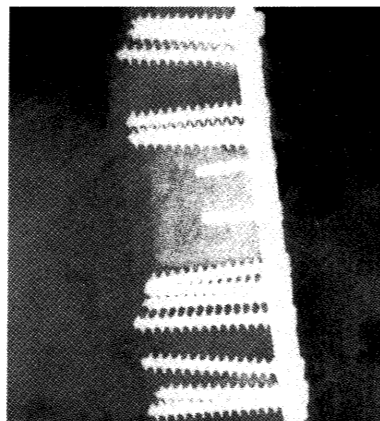


Fig. 3E - Post-op AP view of same patient

### Preoperative Plan

The possible complications of this surgery means that patients should undergo a well defined and documented preoperative preparation. Patient's concerns must be addressed and answered. Blood loss during surgery can be 2-4 units due to muscle stripping and spine decortication, as more levels are explored the blood loss will be greater. The awareness of transmission by blood of infectious diseases has increased the demand for the collection of autologous blood. The intraoperative use of cell savers can help reduce surgical blood loss.

Preoperative testing should include blood work, E.C.G. and X-rays. If the surgery is to be performed as an elective case these procedures can be done as an outpatient thereby shortening hospital stay. X-ray procedures should include flat plate A-P and lateral for an overview of the spine, a CT scan or myelogram to detect stenosis. A M.R.I. may detect other levels of disc disease. If there is tumour involvement a bone scan and M.R.I. may be ordered to identify other areas of involvement.

Chest physio is carried out to familiarize the patient with postoperative procedures that will take place after surgery.

While doing a preoperative assessment the patients lifestyle should be explored. Proper nutrition should

be established to promote tissue healing. An obese patient should be encouraged to diet. Their weight loss will reduce the mechanical stress on the spine.

Patients that smoke are at risk for cardio-pulmonary problems and have a high risk of pseudoarthrosis. It is also felt that smoking leads to a slowed tissue healing process. These patients should be encouraged to stop smoking.

A complete neurologic assessment should be done and precisely documented to provide a preoperative-postoperative comparison. This assessment should include motor, sensory and bowel/bladder function. At this time the patient can be warned of the postoperative temperature and color difference of the lower extremities that will be present due to the sacrificing of the sympathetic chain.

A postoperative home care program should be explored to alleviate the patient and family concerns. This should be done early to allow time if any changes need to be instituted in the home environment.

Elective patients may be fitted for either a TLSO (lumbar) or Jewitt (thoracic) brace. Unfortunately many patients suitable for CASP plates have tumours or fractures and suddenly display neurological complications thereby shortening the preoperative period. In such cases, only the urgent preoperative items are implemented.

### The CASP operation

In the operating room the patient is anaesthetized. The anaesthetist establishes a large bore intravenous catheter for the administration of fluids and blood products. An arterial line is placed in the arm and a foley catheter is inserted into the bladder. Eight units of packed red blood cells, which optimally includes four units of autologous blood, and a cell saver are available (the cell saver is not used in cases with tumours). All sponges, needles and instruments are counted and recorded at the beginning and end of the procedure. The sponges are weighed during the procedure to assist the anaesthetist in determining the total blood loss.

The patient is placed on the operating table in a lateral decubitus position. An overhead arm support is used to permit the dependent arm to be fixed above the head. The lower arm is brought out from the patient and placed on an arm support. A rolled flannel is placed at the apex of the scapula in the axillary space and sandbags are placed at the patients chest and back. Two pillows are placed between the legs. The lower leg is flexed. Adhesive tape is used to secure the patient to the operating table at the scapula and thighs. The legs and arms are covered with warm flannels and a safety strap is placed over the upper leg. Proper positioning is essential to ensure all bony prominence are padded and anatomical alignment of the extremities is maintained.

After a routine orthopaedic skin prep is performed the patient is draped in a thoracic fashion using a plastic drape to secure the draping. Available instrumentation includes a long handled spinal set-up with osteotomes, curettes, Cobb elevators, Kerrisons and pituitaries. Additional retractors, vascular clamps, dissectors, and hemoclips are also added. (Fig. 4 A & B)

The choice of side to approach the anterior spine is generally left retroperitoneal for T12 to L5 and right transpleural for T3 to T12. This is dictated by location of the pathology as the liver on the right is large and difficult to retract. The vena cava is also on the right and may be easily injured.

With a retroperitoneal approach to the anterior spine, the landmarks are the twelfth rib, the umbilicus and the anterior superior spine. Adrenalin (1:500,000) is injected into the subcutaneous and fascia layers to decrease the blood loss. The three layers of the abdominal wall are divided and the dissection of the peritoneum and renal fascia posterior to the kidney is carried out. The peritoneum is not entered. A self-retaining retractor opens the wound longitudinally. A

padded malleable retractor adds further exposure by retracting the kidney and peritoneal contents. The lumbar segmental arteries and veins are isolated, ligated or clipped and cut at the desired vertebral level. The periosteum over the lateral aspect of the spine is divided and elevated on both sides to provide better exposure and protect the iliac vessels. This also allows the CASP plate to lie flat at the time of insertion. The psoas muscle is retracted to avoid nerve root compression. The anterior longitudinal ligament is elevated using sharp dissection. Dissection includes the opposite side of the vertebrae so that the drill guide contour can be placed on the opposite cortex. An osteotome or rongeur is used to remove any osteophytes.

A discectomy is performed for degenerative disc disease; corpectomy for tumours; or decompression for fractures. Bone graft or cement is placed in the defect. Bone graft is harvested from the iliac crest or from the fibula. The graft is measured to fit the disc space or corpectomy defect. At least two grafts are inserted. If a corpectomy has been performed for tumour, bone cement will be used to fill the defect. Gelfoam is placed over the dura following decompression. A strip of polyethylene (PE) film is used as a mould for the formation of the bone cement strut. The cement is shaped and placed in the defect. The PE strip is wrapped around the cement to form a smooth cylinder. When the cement has hardened the PE strip and gelfoam are removed.

The plate is centred over the defect and temporarily held in place with short cortical screws. With the aid of the drill guide the screw holes are drilled, measured and the appropriate screws inserted. At least three screws should be inserted into each vertebral body. (See Figure 5.)

If a transthoracic approach was used, a chest tube is inserted; however, if a retroperitoneal approach there is no need for a drainage tube due to the bodies own ability to reabsorb retroperitoneal fluids.

One gram of Ancef IV is usually given during the latter stages of surgery to augment the dose that was given preoperatively. An x-ray is done in the O.R. to verify the position of the CASP screws.

### Postoperative Plan

If there has been a large blood loss or if there are other serious medical problems the patient will be transferred to ICU. Routine cases are sent to recovery room where they are ventilated until awake. Complete intake and output monitoring is performed as well as continual monitoring of vital signs. A third gram of

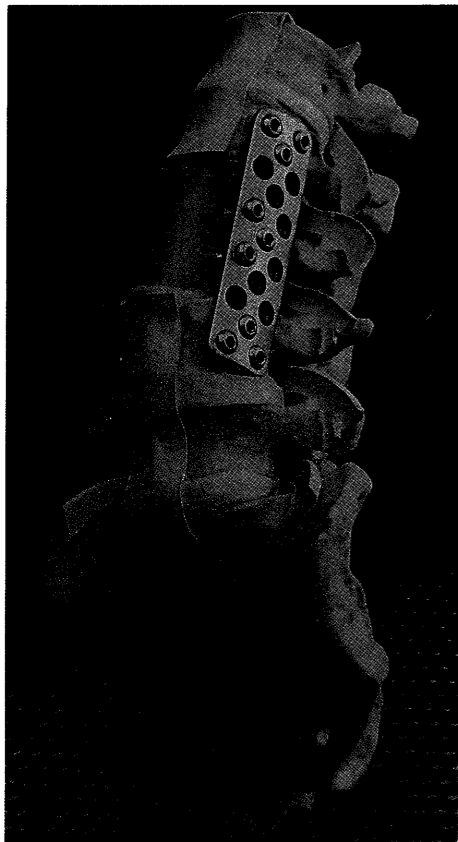


Fig. 5 - Spine model with CASP plate and screw

Ancef is given in recovery room and two more doses are administered over a 24 hour period. A neurologic sensory assessment is done and documented, then compared with the preoperative assessment.

Once the patient is alert and stable they are returned to the ward where deep breathing chest physio is maintained. Passive and active range of motion exercises of the limbs is established. A more complete motor and sensory neurologic assessment is performed and monitored daily.

On the second postoperative day the patient wearing a spinal brace is placed on a spinal chair and raised from a supine position by a pushing mechanism to a sitting position. If patients are neurologically intact, on the third day they will be ambulated with assistance. The spinal brace is to be worn continuously for three months. The brace is removed only to shower.

Abdominal strengthening exercises are initiated at the end of three months for fracture patients, and at the end of six months for tumour patients. X-ray follow up is done after the patient's first time in the spinal chair, six weeks postoperatively and then every three months.

### Conclusion

The CASP system has successfully reduced operating room time in anterior displaced fractures and tumour dissections. This system allows for decompression and stabilization through the use of one, rather than two operative procedures which would include a posterior incision. The multiple screw sites contribute to plate stability.

The simplicity and safety factors of the drill guide have allowed surgeons to feel comfortable when drilling through the vertebrae. The system has also proven itself to be user friendly to both surgeons and to nurses assisting in the surgical preparation.

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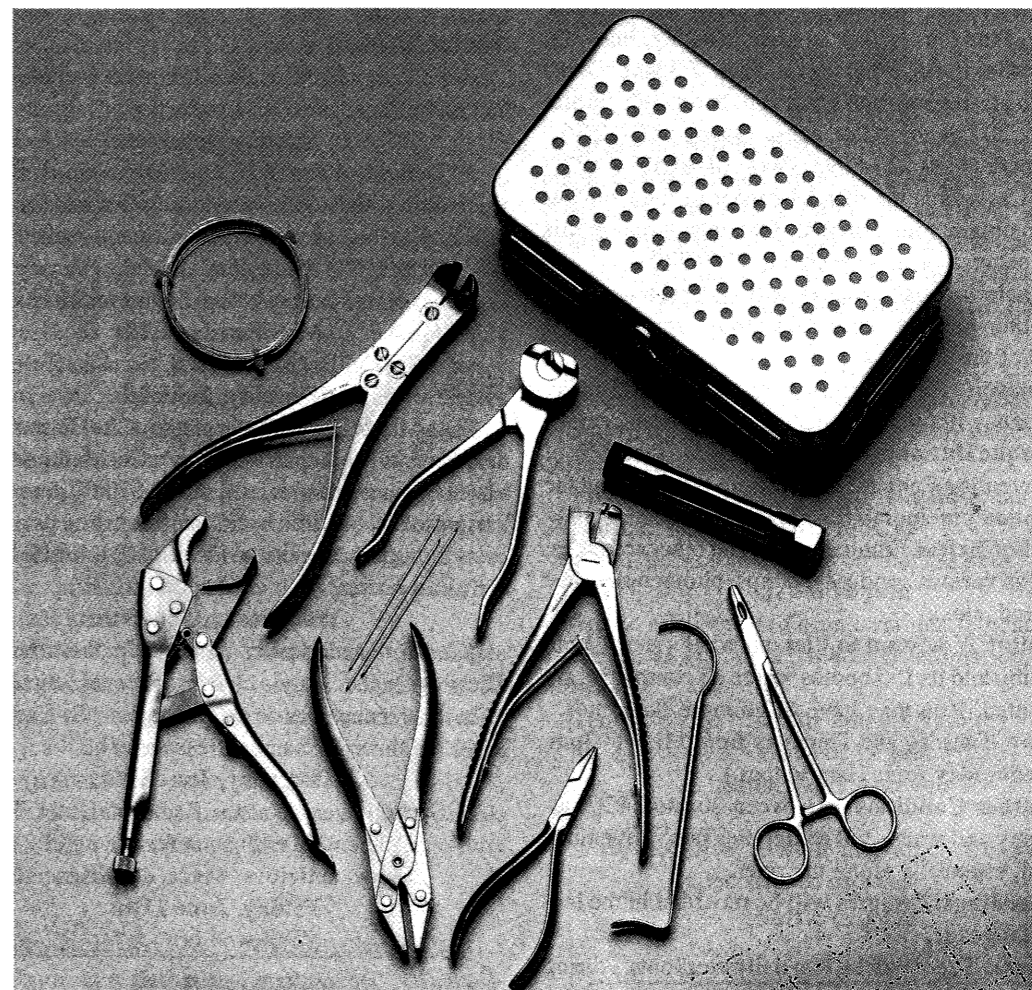
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