Quadratus Lumborum Blocks

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KEY POINTS

- Quadratus lumborum blocks (QLB) are a variation on transversus abdominis plane (TAP) blocks.
- Four different approaches to ultrasound-guided QLB have been described.
- QLB can be used to provide adjuvant analgesia for abdominal, orthopaedic, gynaecological and urological surgery.
- They can be performed in the lateral or supine position with a wedge under the patient's hip.
- The shamrock sign of the psoas, erector spinae and the quadratus lumborum muscles around the transverse process on ultrasound allows identification of the needle insertion point.

INTRODUCTION

Dr. Rafa Blanco first described quadratus lumborum blocks (QLBs) in 2007[1] as a "no pops" transversus abdominis plane (TAP) block. It has been proposed as a more consistent method of accomplishing somatic as well as visceral analgesia of the abdomen than the TAP block and may provide an extended sensory blockade between T4 and L1. It can be used as an adjuvant technique for analgesia but does not provide adequate blockade to be used for anaesthesia.

The QLB was developed to address the fact that as ultrasound imaging for regional anaesthesia has become more widespread, the tendency has been to move the injection point of the TAP block more anterior on the abdominal wall as compared with the original landmark technique, which is at the Triangle of Petit. In moving the injection point more anterior, the efficacy and duration of the TAP block have been compromised, due to the loss of local anaesthesia extension into the paravertebral and epidural space.[2] The QLB involves injecting the local anaesthetic into a more posterior position as compared with the ultrasound-guided TAP blocks, therefore benefitting from the cephalad spread to the thoracic paravertebral space.[3]

According to a recent review published in 2018, all studies published on QLBs so far have shown that QLBs have an outstanding analgesic effect on pain reduction that typically lasts more than 24 hours. This effect is on both rest and movement and allows for early postoperative mobilisation.[4]

Four different approaches to the QLB have been described (Figure 1). Two involve depositing local anaesthetic superficial to the QL muscle (QLM).[5] The QLB1 involves local anaesthetic being deposited anterolateral to the QLM, lateral to the transversus abdominis muscle. The QLB2 requires the local anaesthetic to be injected more posterior on the QLM, between the muscle and the thoracolumbar fascia. Two other techniques have been described: (1) the transmuscular[6] or the QLB3, in which the needle is passed through the QLM and local anaesthetic is deposited between the psoas muscle and the QLM, and (2) intramuscular injection of local anaesthetic[7] into the QLM. To date, no large trials have been conducted to compare the efficacy of these blocks with each other; however, the intramuscular approach may produce less paravertebral spread.[8]

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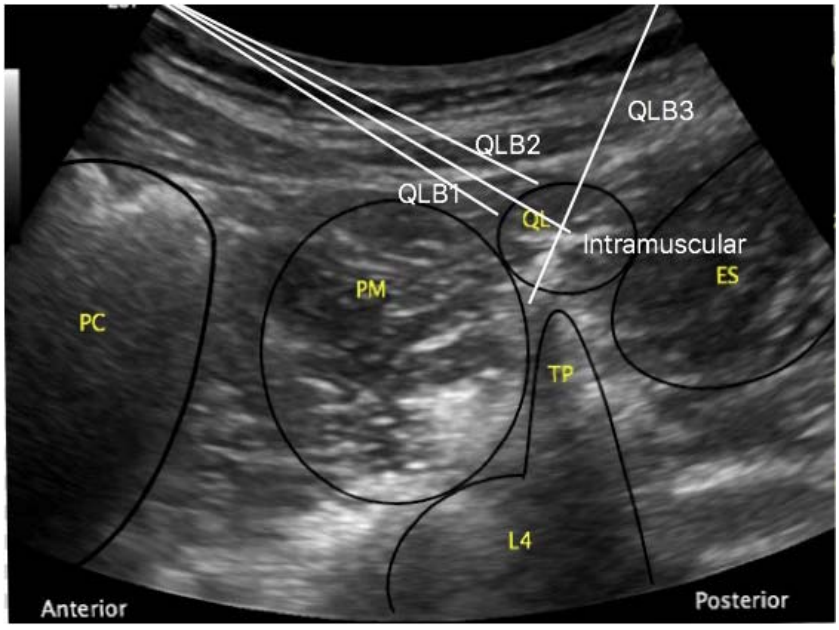

Figure 1. Needle trajectories are shown in white for the QLB1, QLB2, QLB3 and intramuscular approaches. ES, erector spinae; L4, fourth lumbar vertebra; PC, peritoneal cavity; PM, psoas major; QL, quadratus lumborum; TP, transversus process.

This tutorial will outline the anatomy and the techniques used to perform the QLB1, QLB2, QLB3 (transmuscular) and intramuscular blocks.

ANATOMY

The area contained within the costal margin and xiphoid process of the sternum superiorly, the inguinal ligament and pelvic bone inferiorly and the spinal column posteriorly is described as the abdominal wall.

Muscles of the Abdominal Wall

The anterolateral abdominal wall consists of 3 flat muscles: the external oblique, the internal oblique and the transversus abdominis, arranged in concentric layers. Each of these muscle layers has its individual fascia sheath. There are paired vertical muscles, the rectus abdominis muscles, which are in the midline lying on either side of the linea alba.

The 3 flat muscles are as follows:

- External oblique: the largest and most superficial muscle layer. It arises from the inferior borders of the 5th to 12th ribs and inserts into the linea alba, the pubis and the iliac crest. The fibres run anteromedially.
- Internal oblique: runs perpendicular to the external oblique. It begins in the thoracolumbar fascia, the lateral half of the inguinal ligament and the anterior two-thirds of the iliac crest. It then runs superiomedially to the inferior borders of the 10th, 11th and 12th ribs and the linea alba.
- Transversus abdominis: the innermost muscle. It arises from the inguinal ligament, the thoracolumbar fascia and the lower 6 ribs. It runs transversely, ending in a broad aponeurosis that inserts into the linea alba medially.

The posterior abdominal wall consists of the erector spinae muscles; the QLM, which extends from the 12th rib to the iliac crest; the iliacus; the psoas major and minor; the latissimus dorsi and the diaphragm. The psoas muscle lies medial and anterior to the QLM. The QL lies between the muscles in the anterolateral abdominal wall and the paravertebral space. The thoracolumbar fascia is a complex tubular structure of blended aponeuroses and fascial layers that encases the deep muscles of the back.[3] It extends from the lumbar to the thoracic spine and splits into 3 layers. The posterior and middle layers enclose the erector spinae muscles; the middle and anterior enclose the QLM. The posterior and middle layers of the thoracolumbar fascia fuse again lateral to the paraspinal muscles and merge with the aponeurosis of the internal oblique and the transversus abdominis (Figure 2)[9].

Sensory Supply of the Abdominal Wall

The lower 7 thoracic nerves and the first lumbar nerve supply the abdominal wall sensation.

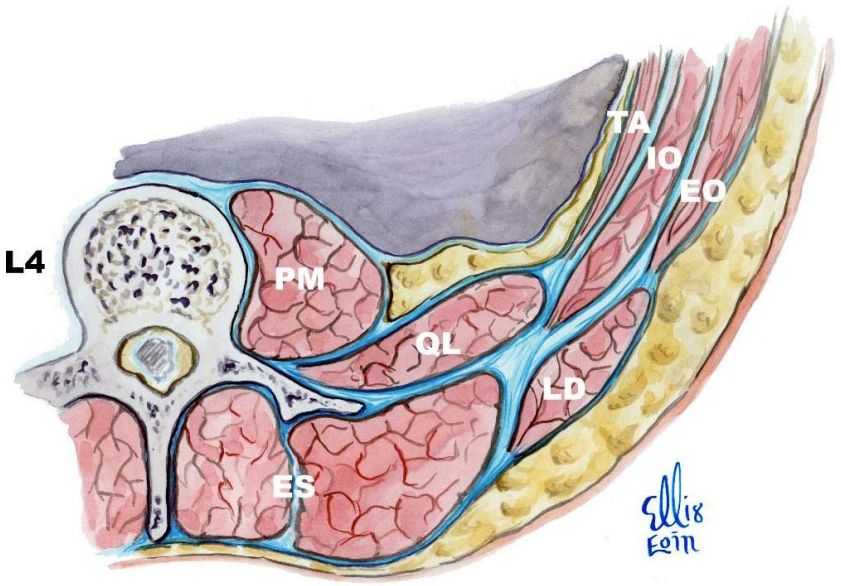

Figure 2. Cross section of the abdomen at the level of L4.[9] EO, external oblique; ES, erector spinae; IO, internal oblique; LD, latissimus dorsi; PM, psoas muscle; QL, quadratus lumborum; TA, transversus abdominis. Blue represents the thoracolumbar fascia. Used with permission.

- Thoracoabdominal nerves are continuations of the T6-T12 intercostal nerves, as they travel anteriorly. T12 is often referred to as the subcostal nerve. They give off lateral cutaneous braches in the mid-axillary line, which supplies the lateral abdominal wall. Their anterior branches subsequently emerge from the costal margin and travel in the TAP, which lies between the internal oblique and the transversus abdominis muscle. T6-T9 enters the TAP medial to the anterior axillary line, and the lower nerves enter it more laterally.
- Ilioinguinal and iliohypogastric nerves are typically the terminal branches of L1, although there is significant variability. They emerge at the lateral border of the psoas major and run inferolaterally on the ventral surface of QLM and transversus abdominis superior and parallel to the iliac crest.[3] They pierce the transversus abdominis muscle and enter the TAP. They ascend through the internal and external oblique muscles to supply the abdominal wall in the inguinal and pubic regions.

QLB INDICATIONS AND CONTRAINDICATIONS

Indications and contraindications are listed in Tables 1 and 2, respectively.

QLB COMPLICATIONS

Fortunately, complications are very rare but may include the following.

- Block Failure
- Local anaesthetic toxicity
- Sympatholysis causing hypotension
- Bowel injury
- Kidney injury
- Infection
- Vascular injury
- Unwanted femoral nerve block

TECHNIQUE

The QLB is a field block, so it requires depositing a large volume of local anaesthetic. Bilateral blocks are necessary for midline incisions because of the nerve supply of the abdominal wall. Ultrasound guidance is necessary to perform the block.

General Preparation

Consent must be obtained from the patient prior to the procedure.

You will need the following:

Type of Surgery	Procedure
Abdominal	Laparotomy
	Abdominoplasty
	Open and laparoscopic appendicectomy
	Cholecystectomy
Obstetric and gynaecologic	Caesarean section
	Total abdominal hysterectomy
Urologic	Open prostatectomy
	Renal transplant surgery
Miscellaneous	Iliac crest bone graft
	Hip surgery

Table 1. Indications for QLB

- Intravenous access established
- Routine monitoring applied, including oxygen saturations, blood pressure and electrocardiogram
- Resuscitation equipment and medications available
- Trolley and sterile pack
- Sterile gloves and mask
- Antiseptic solution for skin preparation (chlorohexidine 0.5%)
- A needle: a 22-gauge ultrasound needle 50 to 100 mm (for most patients, 100 mm will be used) or a 18-gauge Tuohy needle
- Sterile gel
- Probe cover
- Ultrasound machine with a curvilinear probe
- 20-mL syringes
- Long-acting local anaesthetic (bupivacaine, levobupivocaine, or ropivocaine), with the maximum allowable dose calculated to avoid toxicity; normal saline is used to make the volume up to 20 mL on each block side
- ‘‘Stop before you block’’ should be carried about before the block to confirm the patient’s name, surgery and side of surgery if not midline

Performing the Block

An In-Plane Needle Approach Is Used for All 4 QLB Techniques

The setup for all 4 blocks is the same (Figure 3). The blocks can be performed with the patient awake prior to surgery, with some sedation if required; however, it is usually performed under general anaesthetic.

The patient is ideally placed in the lateral decubitus position with a pillow placed under the hip with the side to be injected uppermost (Figure 3). In obese patients, this positioning is usually necessary to perform the block, even under general anaesthetic. In the nonobese anaesthetised patient, it may be easier to place a bag of fluid under the hip in the supine position to obtain access to the flank. The patient’s hip is lifted with a light roll, and a 5-L bag of fluid or a wedge is placed under the hip of the side to be blocked. This is easier then putting the patient in the lateral position and will usually allow for good ultrasound images and will provide adequate exposure for needle insertion. The ultrasound is positioned on the side of the bed opposite to the side being blocked (Figure 4).

A curvilinear probe with a frequency of 2 to 6 Hz is usually necessary to perform the block. However, in a very thin person, a linear probe may be adequate to achieve the necessary penetration. While sitting behind the patient, place the ultrasound probe horizontally just cranial to the iliac crest. The ‘‘shamrock sign’’[9] should become visible (Figure 5). The shamrock sign is

Absolute
Patient refusal
Allergy to local anaesthetic
Relative
Coagulopathy
Anticoagulants
Systemic infection

Table 2. Contraindications for QLB

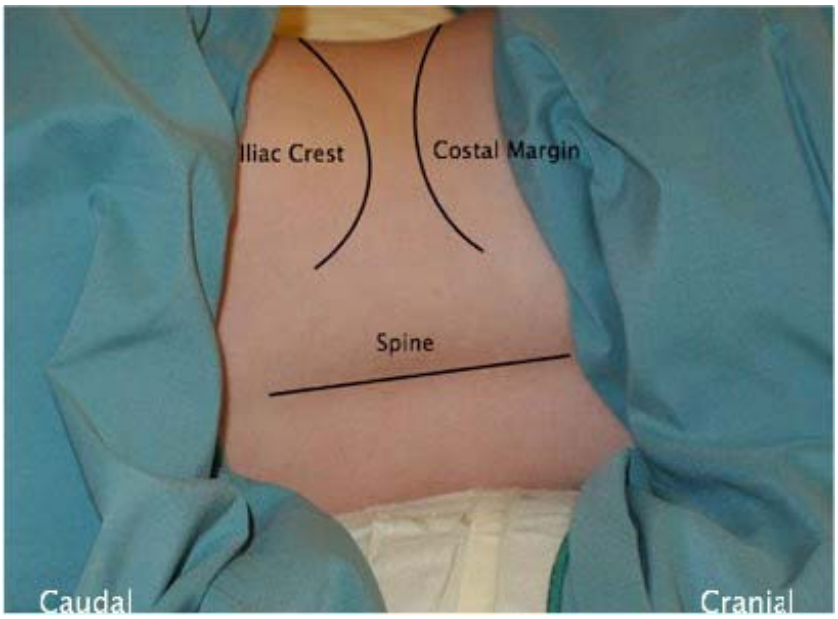

Figure 3. Patient position for performing QLB. In this picture, the patient is in the right lateral decubitus position.

so named because the 3 muscles, the psoas muscle, the QLM and the erector spinae, cluster around the transverse process to resemble a shamrock (Figure 6). The transverse process points at the QLM at the top of the shamrock.

If the image is not readily observed, leave the probe just cranial to the iliac crest and move the probe medially and identify the 3 abdominal muscle layers, the external oblique, internal oblique and transversus abdominis, as you would for a TAP block. Then move the probe laterally and observe the abdominal muscle layers tapering, and you will see the shamrock sign come into view.

If you continue to move the probe more laterally, the kidney and peritoneum will be seen. In a thin person, this is very close to the QLM, demonstrating the risk of damaging these structures (Figure 7).

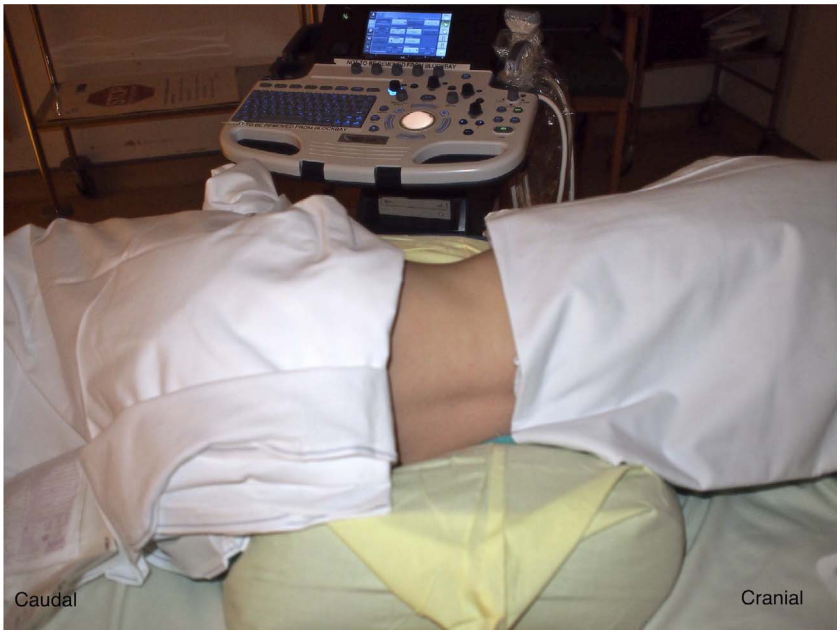

Figure 4. Ultrasound and patient position. In this picture, the patient is in the right lateral decubitus position.

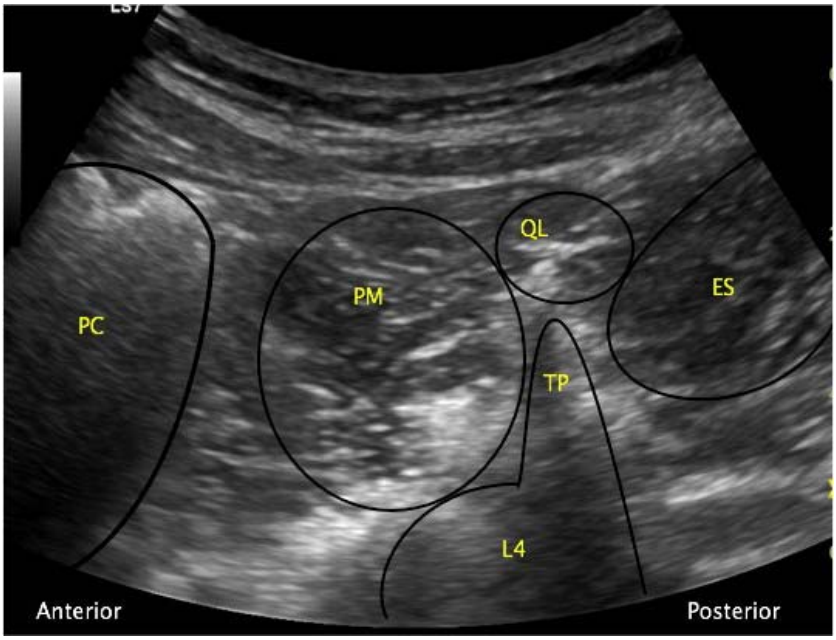

Figure 5. The ‘‘shamrock sign’’; image with curvilinear probe. ES, erector spinae muscle; L4, fourth lumbar vertebra; PC, peritoneal cavity; PM, psoas muscle; QL, quadratus lumborum muscle; TP, transverse process.

Quadratus Lumborum Block 1

The QLB1 involves local anaesthetic being deposited anterolateral to the QLM, lateral to the transversus abdominis muscle. The needle insertion point is anterior to the probe (Figure 8). The needle is advanced in-plane to the tapered border of the transversus abdominis muscle, lateral to the QLM (Figure 1). When this point is identified, 20 mL of local anaesthetic is deposited.

Quadratus Lumborum Block 2

The QLB2 requires the local anaesthetic to be injected more posterior on the QLM, between the muscle and the thoracolumbar fascia. The needle insertion point is anterior to the probe (Figure 8). Advance the needle, in-plane, in a slightly shallower trajectory to reach a point on the dorsal surface of the QLM. The aim is to deposit the local anaesthetic between the QLM and the thoracolumbar fascia, which separates the muscle from the latissimus dorsi or the paraspinal muscle.

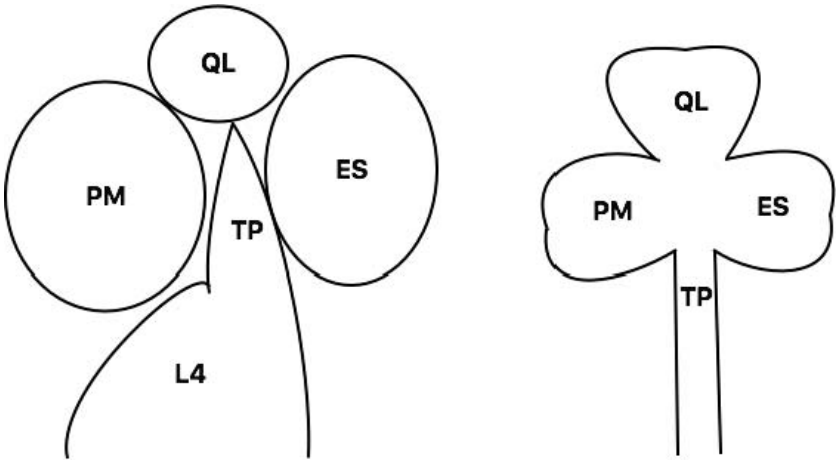

Figure 6. Shamrock sign. ES, erector spinae; L4, fourth lumbar vertebra; PM, psoas major; QL, quadratus lumborum; TP, transverse process.

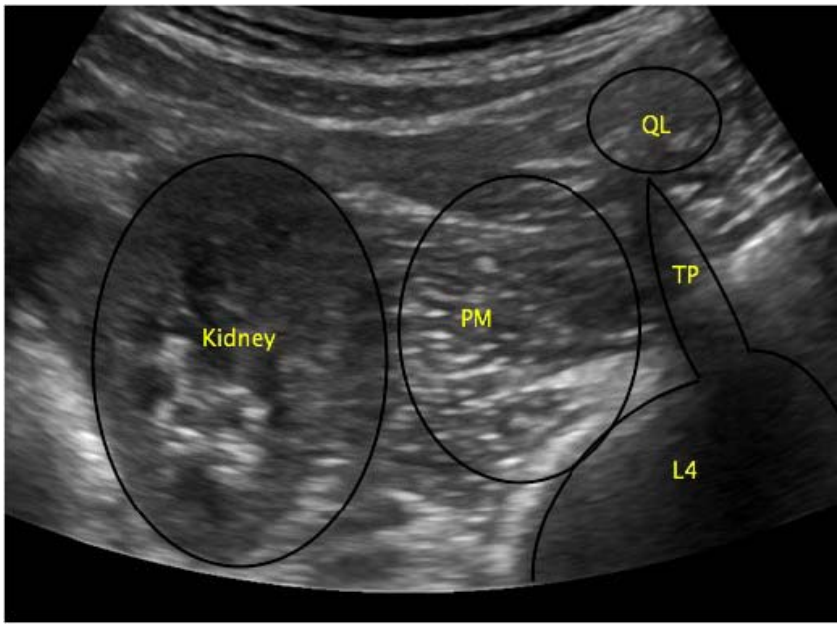

Figure 7. Image for QLB with kidney in view. L4, fourth lumbar vertebra; PM, psoas muscle; QL, quadratus lumborum muscle; TP, transverse process.

Quadratus Lumborum Block 3 (Transmuscular)

The QLB3 is performed in the lateral position with a posterior insertion point. The needle is inserted posterior to the probe. It involves identifying where the QLM meets the psoas muscle as it attaches to the transverse process of L4. The direction of the needle trajectory is anterolateral. The needle is advanced through the posterior lamina of the thoracolumbar fascia, the belly of the QL, the anterior layer of fascia investing the QLM until it reaches this endpoint (between the psoas muscle and the QLM). This is the location for local anaesthetic deposition (Figure 1).[10] The transmuscular approach can also be performed in the supine position with a wedge under the hip, as with the other described QLB approaches.

Figure 8. Needle insertion point for QLB 1 and 2. The patient is in the right decubitus position.

Intramuscular Block

The local anaesthetic is deposited into the body of the QLM. It is performed by advancing the needle, in an anterior to posterior approach, until it pierces the thoracolumbar fascia, which envelopes the QLM. The needle is then inserted into the body of the QLM. A test dose is given, and the spread of local anaesthetic is observed in the body of the muscle. Then, the rest of the local anaesthetic is injected.

In all cases, hydrodissection may be required to aid the visualisation of the needle endpoint, as the needle may be difficult to see on the ultrasound image, especially with a curvilinear ultrasound probe. If the patient requires bilateral blocks, it is then necessary to reposition the patient and perform the block on the opposite side.

SUMMARY

- The QLB offers effective adjuvant analgesia for abdominal surgery
- The QL lies between the anterior muscle layers and the paravertebral space and the efficacy is due to extension into the paravertebral space
- Different approaches to QLB have been described with no large studies to show which is the most effective approach

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