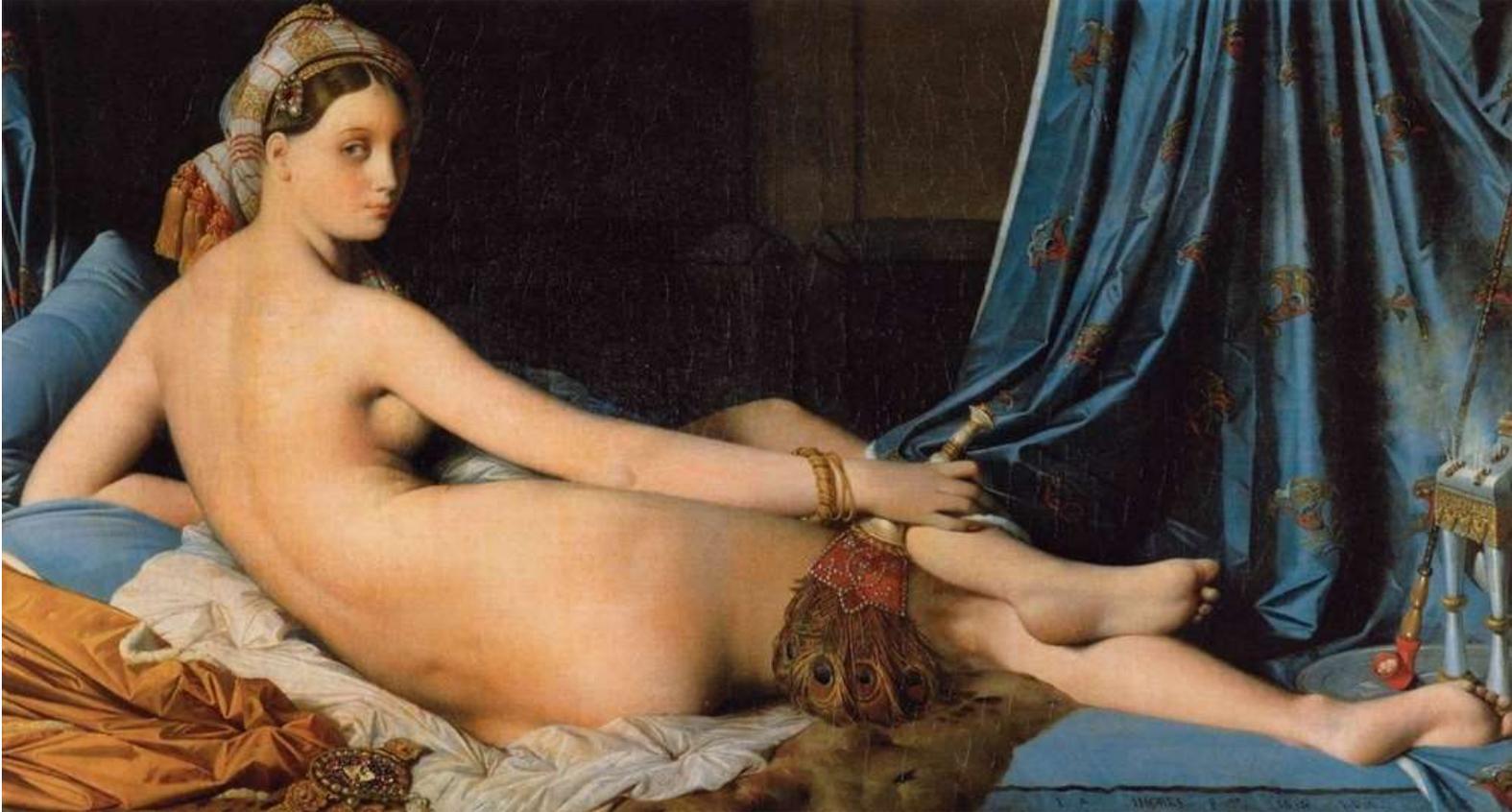


SONOGRAPHY OF LUMBAR PUNCTURE



“La Grande Odalisque”, oil on canvas, 1814, Jean Auguste Dominique Ingres. Musee du Louvre, Paris.

Jean Auguste Dominique Ingres, greatly celebrated throughout Europe in the mid-Nineteenth century always considered himself a Neoclassical painter. Indeed he trained under the greatest Neoclassical painter of all time, the immortal Jacques Louis David. With such an illustrious teacher one would suppose that Jean Auguste would have slavishly imitated his master’s grand style. Though he revered the great man, Jean Auguste was to be his own man, willing to explore his own inclinations and emotions rather than to simply follow in David’s wake like so many others. By the 1820s the political situation in France had drastically altered to what had existed since 1789. Napoleon had finally been defeated though only through force of overwhelming odds. David would lose favour and Neoclassicism its reason for existence. If Neoclassicism was to survive, it would have to find a new high priest. Jean Auguste Dominique Ingres would be that high priest.

The French monarchy had been restored under Louis XVIII, and the people were tired of politics and war. The Neoclassical movement had begun in the 1750s, partly, like so

many other movements throughout history, as a reaction against what had preceded it, in this case the Rococo style of the age of Louis XV, which by the mid-Eighteenth century had become increasingly viewed as frivolous and insubstantial.. But Neoclassicism was also driven in part by the stupendous archeological discoveries of the remains of First century A.D Roman towns beneath the ashes of an ancient volcanic eruption. Both these factors saw a determined revival in the fine arts of the disciplined and exacting standards of classical Greek art and the Renaissance. When the great Revolution in France broke out, art discovered a new and noble cause. Radical politics in both America and Paris, based on the ideals of the French Philosophes and of the Age of Reason, cried out for a new art form to bring these ideals to the people. As the Baroque of the Eighteenth century in Italy, and Socialist Realism in Twentieth century Russia had become the heavy artillery of political ideologies, so Neoclassicism became the heavy artillery of French Revolutionary political philosophy.

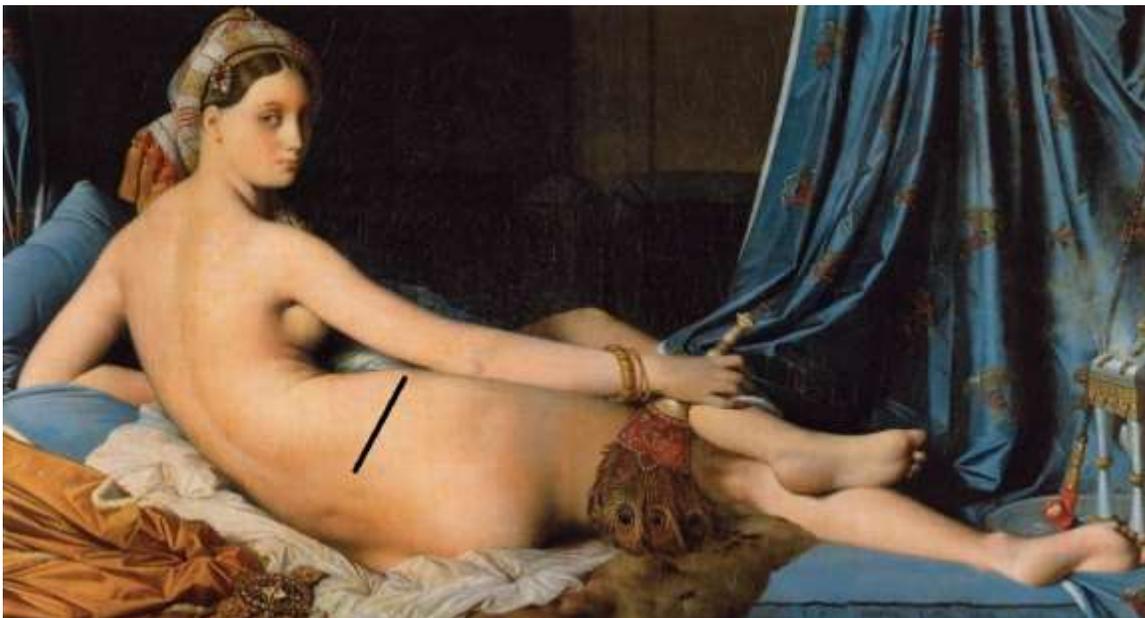
As the Revolutionaries strove to create a new society based on the democracies of ancient Greece and the old Roman Republic, Neoclassicism was commandeered for the quest for beauty and perfection in art. And the greatest exponent of the political masterpiece in the time of the Revolution, indeed in any time was Jacques Louis David. He wrote, "To give a body and a perfect form to one's thought: this and only this, is to be an artist". For David, art and politics were inseparable. His unrivaled masterpieces would help fuel two decades of war and bloodshed on an unprecedented scale. Indeed David himself was very much an active revolutionary. A regicide, he also sat in the National Convention, and was a firm supporter of the infamous Maximilien Robespierre.

Jean Auguste Dominique Ingres was a Neoclassical painter, but he was no revolutionary. He spent the years of the Revolution and the Napoleonic wars in Italy, and only returned to his homeland after the restoration of the Monarchy. By this time, France, indeed all of Europe had become tired of internecine war and bloodshed. The political statements of art no longer held the interest of the people who simply wanted to live in peace and get on with their lives. As art reinvented itself in the form of Impressionism, in part as a reaction to the grim years of the Franco-Prussian War and the Commune so Neoclassicism reinvented itself after the fall of Napoleon Bonaparte. Neoclassicism had originated as a return to the ideals of antiquity and the Renaissance. It then became political propaganda. Jean Auguste would be the great exponent of the third phase of Neoclassicism, and he would continue to champion its noble aspects into his late age, even though by the 1850s a number of other genres, such as Realism in particular, were replacing it in popularity. To keep Neoclassicism alive Ingres developed it in a number of different ways to his old master Jacques Louis David.

Though Ingres did in fact consider himself a history painter in the grand original tradition of Neoclassicism, he did not involve himself in politics, and his large history paintings are not nearly so grand or so majestically inspiring as David's. Initially he did not gain very much recognition when he returned to Paris, but with time his smaller and more intimate portraits of "Odalisques" (loosely, Turkish Harem women, a favourite motif of the time) gradually began to catch the attention of both public and connoisseur. His smaller scale new subject matter, and his skills with cool colors, smooth surfaces with imperceptible brush strokes was Neoclassicism on a more human and intimate scale. Indeed rather than adhering to the rigid protocols and the rules of "Academic Art", his

long elegant lines, seen in his harem women are reminiscent of elements of the Mannerists of the Sixteenth century, and of El Greco in particular. As with the Mannerists, this exaggeration and stylization depicted a sense of sensuality and seduction not previously a dominant motif of Neoclassicism. Ingres's particular style, although meant to be distinct from, has many similarities with the Romantic style also popular in the early and mid Nineteenth century. One of Ingres's most famous works is "La Grande Odalisque" of 1814, which hangs today in the Musee du Louvre. It shows all the typical features of Ingres's work. The smooth skin of the Odalisque shows virtually no sign of brush work. The colors are muted and cool. This is not history on the grand scale. There is no grand Davidian message, rather the scene is close up, private and sensual.

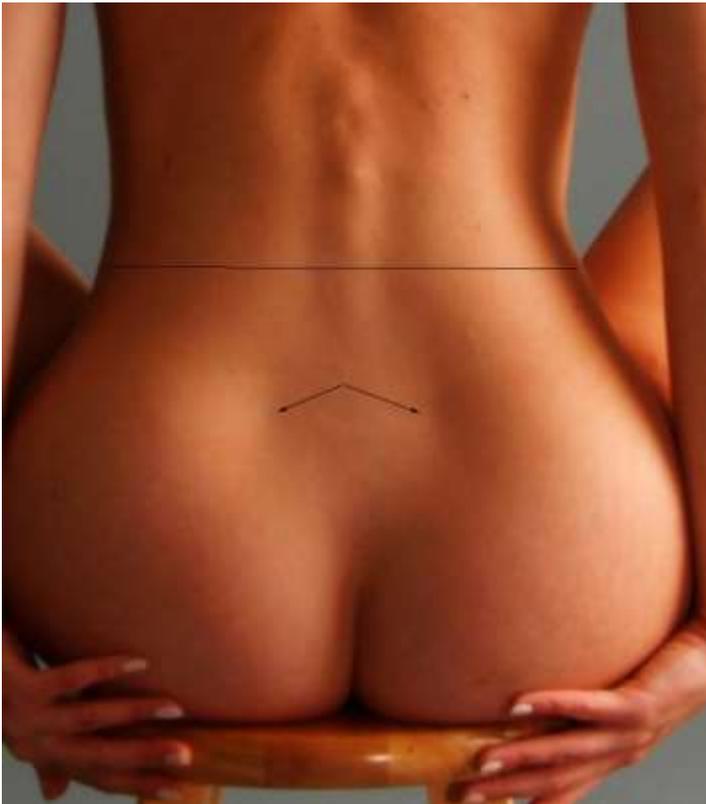
The long elongated back of La Grande Odalisque to the eye of the art historian immediately suggests an element of Mannerism. Interestingly to the sharp and astute medical eye, a careful inspection of the Odalisque's spine shows up just exactly how Ingres constructed his Mannerist stylization! The two impressions on the female back, known to anatomists as the "fossae lumbales laterales", (...or to those of more romantic sensibilities, "the Dimples of Venus"), are normally a surface anatomy feature that marks out the position of the posterior superior iliac spines at the level of S2. The dimples are created by a short ligament that stretches between these spines in women. The Odalisque's dimples are seen right at the intercrystal line, in others words at around L4-5. The posterior superior iliac spines are much further down than this. The Odalisque to the eye of the artist has a sensual elongation. So to the eye of the medical professional the Odalisque simply has an extra vertebra or two! When we perform a lumbar puncture our traditional landmark is the intercrystal line, that joins the tops of the iliac crests, at L4-5....in most people that is....but human anatomy, as Jean Auguste Dominique Ingres, shows us is not invariable! To assist us in our lumbar puncture landmarks in patients who do not conform to the majority therefore, we need, like Ingres, to modify the traditional approach. One method is by the assistance of ultrasonography.



The intercrystal line on Ingres's Odalisque intersects with her "dimples of Venus"



The intercrystal line on Jules Joseph Lefebvre's "Odalisque" of 1874, shows a more anatomically correct depiction of the "dimples of Venus", with respect to their more caudal position in relation to the intercrystal line which joins the tops of the iliac crests.



*Left: Model demonstrates for us the usual anatomy; her dimples of Venus are well below her intercrystal line!
(Adapted from Wikipedia)*

SONOGRAPHY OF LUMBAR PUNCTURE

Introduction

The objectives for ultrasound guidance of lumbar puncture include:

- Locating the best site for needle insertion.
- Showing the appropriate angle for needle insertion.
- Measuring the distance for needle insertion.
- Looking for any unexpected anatomical abnormalities.

Technique

1. Probe selection:

- Use the **linear probe** for thin and paediatric patients.
- The **curvilinear probe** may be needed in larger patients.

2. Position the patient:

- The procedure should ideally be performed with the patient sitting upright over the edge of the bed as this increases the interspinous distance and leads to higher success rate.

3. Use a sterile surgical marker over dry skin.

4. Determine the midline and intercrystal plane:

- Palpate both iliac crests and draw a line to connect this intercrystal line which variably represents the L4 vertebra.

5. Probe placement:

- Next apply the probe transversely at the level of the intercrystal line and perpendicular to the long axis of the patient's spine.

Look for the spinous processes.

They appear as hyperechoic regions with posterior shadowing.

Centre the probe in the middle of the screen and mark the back.

Scan two more spinous processes to outline the spinal curvature.

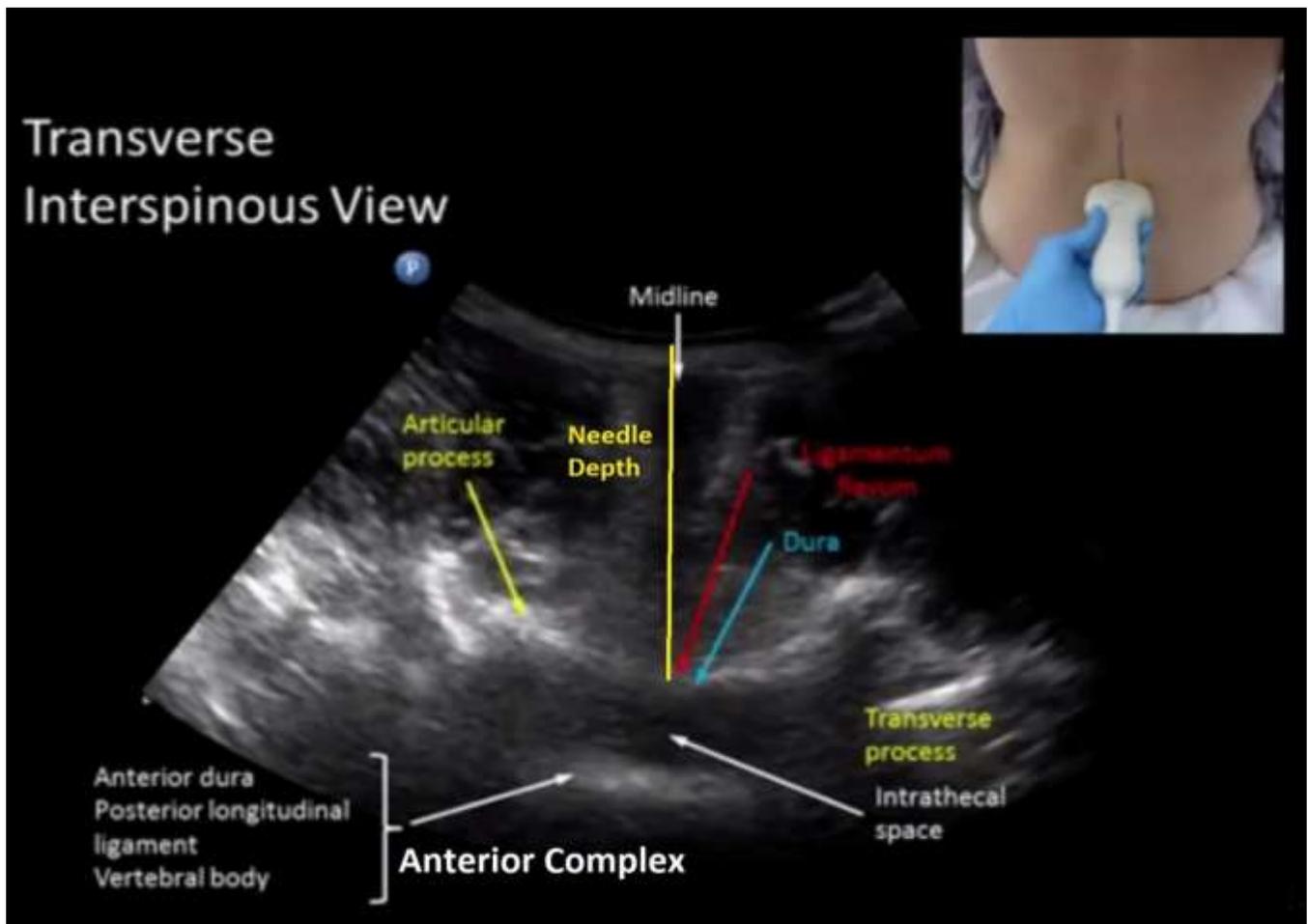
Occasionally, the hyperechoic rim of the spinous process is not well visualized and only the anechoic shadow identifies the target structure.

Often paired hyperechoic structures may be seen surrounding the spinous process such as the transverse processes which can be used to determine the midline.

6. While still in transverse slide the probe cranially to reveal the anterior complex appearing out of the acoustic shadow.

This comprises the anterior dura, posterior longitudinal ligament and posterior aspect of the vertebral body.

Save the image and measure the expected needle depth.



Determining the needle insertion point:

To determine the insertion point the probe is rotated in longitudinal plane and applied to the spine in the midline position.

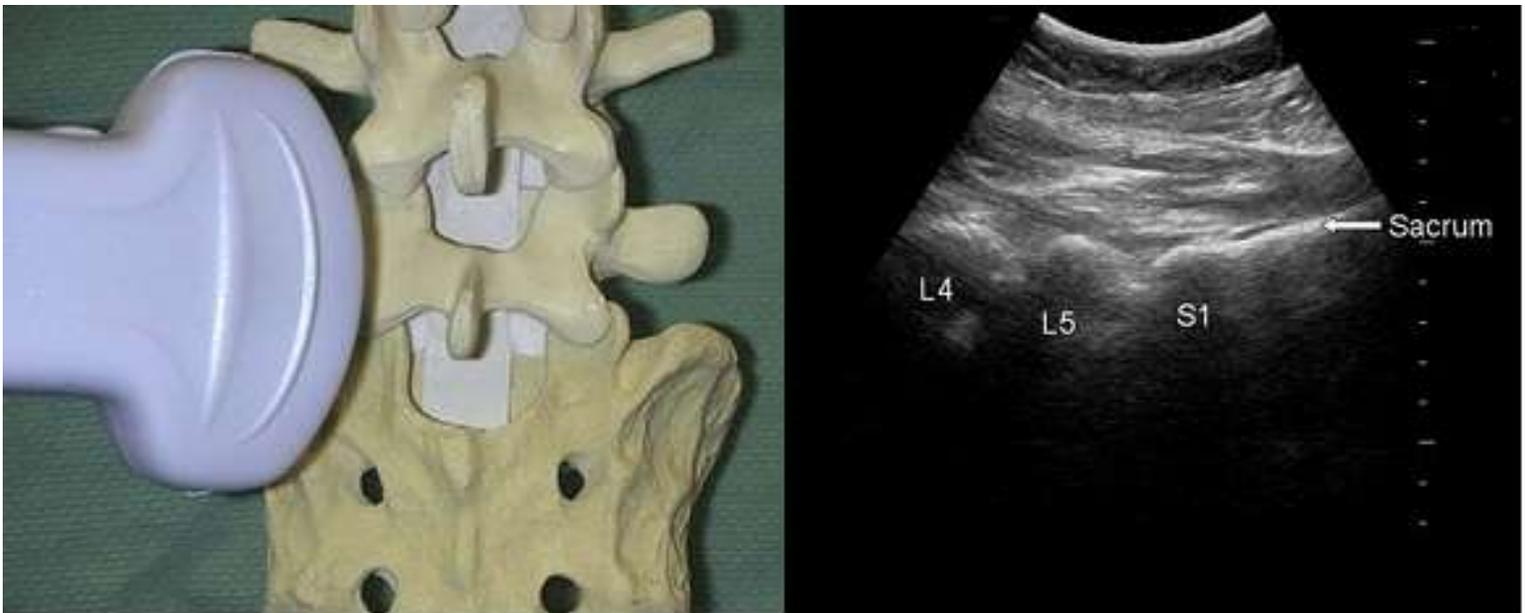
Begin at the L5-S1 level noting that the sacrum is flat with **no** spinous processes or interspinous spaces.

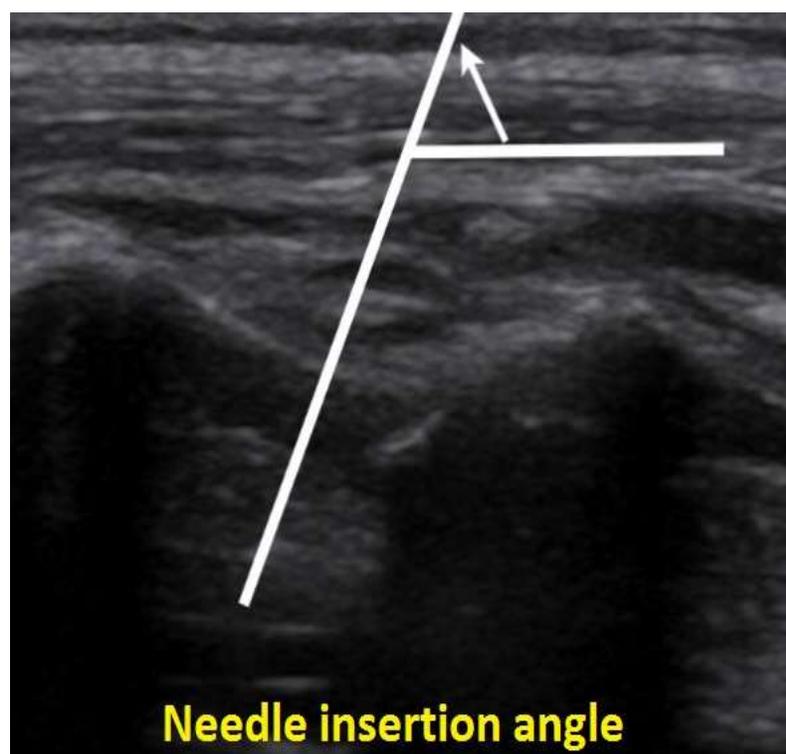
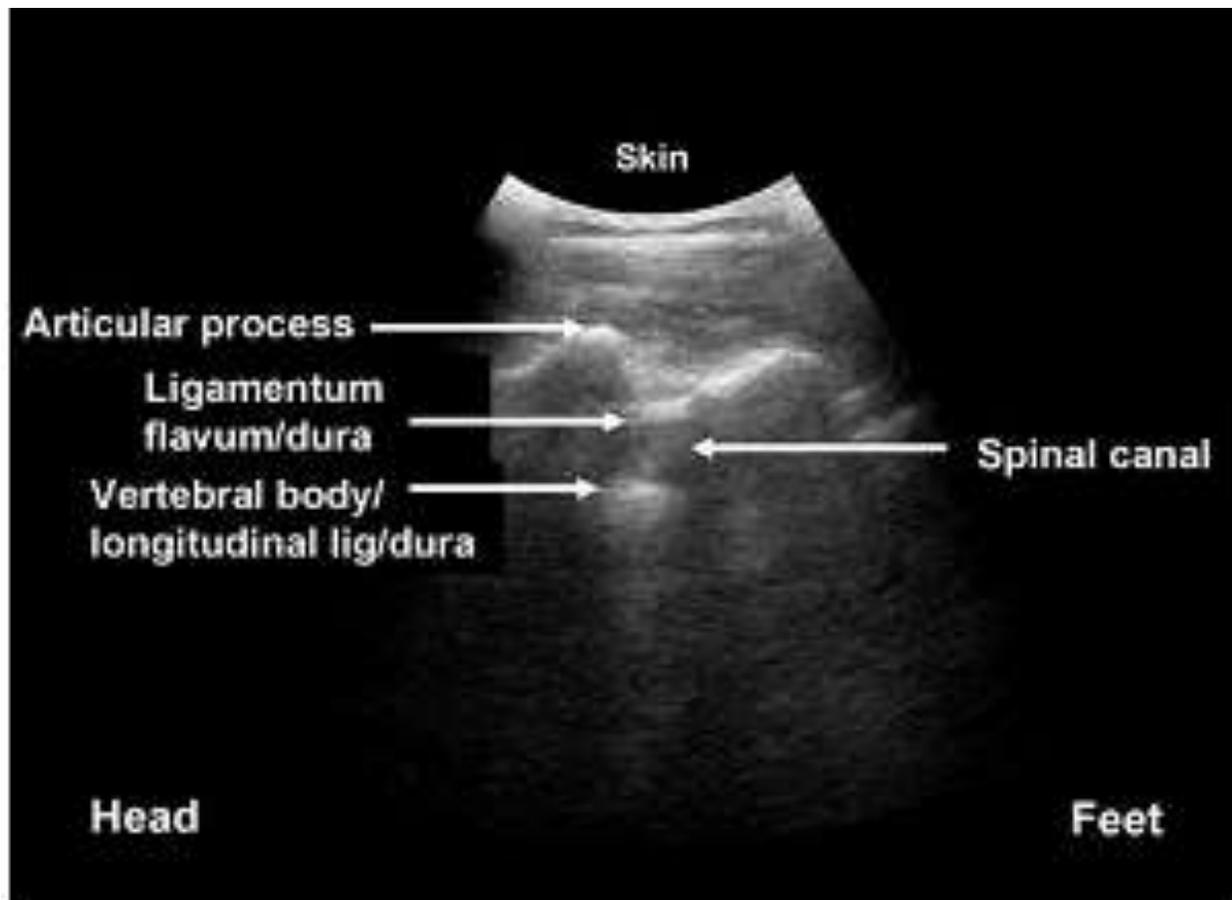
Identify the picket-fence pattern of the lumbar spinous processes as rounded **hyperechoic** curves with posterior shadowing and periodic windows between the processes.

Move cranially by two spinous processes to the level of the intercrystal line, positioning the interspinous space in the middle of the screen and mark this level as well as the next one up.

Finally, note the needle insertion angle needed.

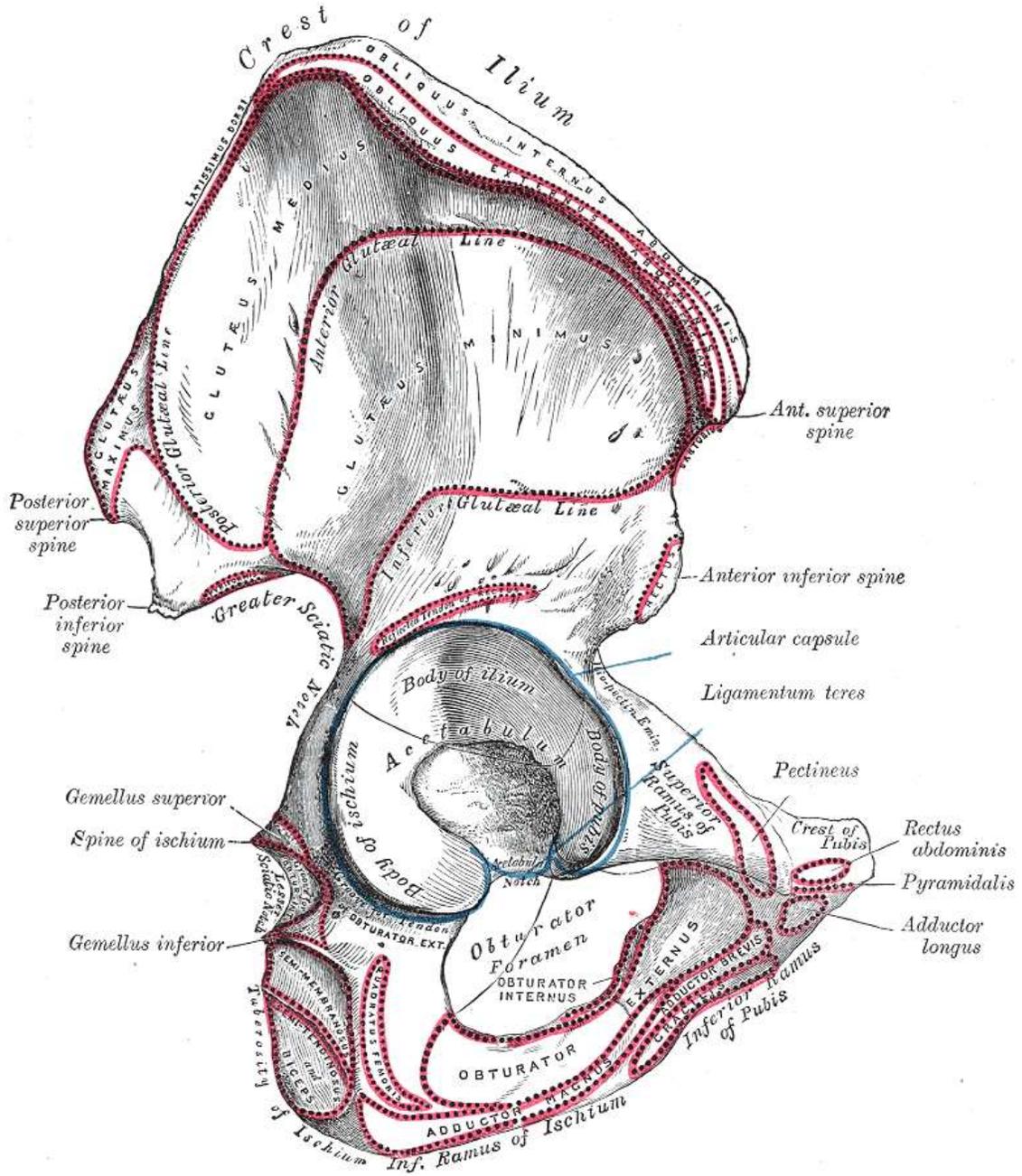
Now that your landmarks are marked perform the procedure in the aseptic method.







Appendix 1



Lateral view of the right pelvis. Note that the **top of the iliac crests** mark the intercrystal line at the level of **L4-5**. The **posterior superior iliac spine** lies well below this at the level of **S2**. (Gray's Anatomy 1918).

References

1. Maximize first pass success in patients with a large body habitus
Lumbar Puncture in EMDOCs Website:
 - <http://www.emdocs.net/>
2. Ultrasound-Guided Procedures in the Emergency Department; Diagnostic and Therapeutic Asset; Emerg Med Clin N Am 31 (2013) 117 - 149.

Dr Peter Papadopoulos
Dr James Hayes
23 February 2016.