MERGING PHYSICS WITH ANESTHESIA – THE SOTA OMOIGUI SHORT NEEDLE TECHNIQUE FOR INTERVENTIONAL PROCEDURES

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MERGING PHYSICS WITH ANESTHESIA – THE SOTA OMOIGUI SHORT NEEDLE TECHNIQUE FOR INTERVENTIONAL PROCEDURES

Presented During:

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Thursday, May 16, 2019: 4:45 PM - 6:15 PM
The Fairmont Queen Elizabeth
Room: Place du Canada / Square Dorchester

SOCCA Poster Session (index.cfm?do=ev.viewEv&ev=1931)
Friday, May 17, 2019: 10:45 AM - 12:15 PM
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IARS Poster Session (index.cfm?do=ev.viewEv&ev=1717)
Monday, May 20, 2019: 12:30 PM - 2:00 PM
The Fairmont Queen Elizabeth
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Session Number:

1843

Session Type:

Abstract Submissions

Introduction:

Current guidelines for procedural injections e.g. spinal nerve blocks, intercostal blocks, require the length of needle to ensure that the needle tip is inserted to the nerve that needs to be blocked.

The use of long and larger gauage needles may be associated with complications from needle insertion including trauma to the structures traversed.

Utilizing laws of physics, including the equation of continuity and the principle of conservation of mass, and incorporating these into the practice of regional anesthesia, we describe the Sota Omoigui Short Needle technique, for procedural injections and increased safety of such injections.

We have employed this short needle technique in more than 500 procedural injections with good success and no complications.

Methods:

Utilizing ultrasound guidance, to measure the distance traveled of 1-2 mls of a clear solution of Lidocaine 1%, injected from a 30G 5/8 inch (15.6 mm) needle, using a 3 mls syringe. Assessment of the anesthetic block resulting from this novel technique.

Results:

During ultrasound guidance for spinal procedures, in 100 patients, we observed that 1-2 mls of a clear solution of Lidocaine 1%, injected from a 30G 5/8 inch (15.6 mm) needle, using a 3 mls syringe, and inserted just lateral to the spinous processes of L4-S1, into the paraspinal muscles, traveled a distance of 4-6 cm. This distance was sufficient to travel down to the vertebral lamina and within minutes produce anesthetic block and relieve lower back pain as well as radicular pain from the nerve roots. Injection of 1-2 mls of Lidocaine 1% with a 30G 5/8 inch (15.6 mm) needle, using a 3 mls syringe, over the midpoint of one or multiple ribs, in 20 patients with rib pain, provided an intercostal nerve block, and relief of pain within minutes. Such intercostal nerve block was achieved without inserting the needle to slip below the inferior border of the rib, as described in most procedural textbooks for intercostal nerve block.

Conclusion:

It is therefore not necessary to use longer and bigger gauge needles for many intramuscular or procedural injections, as the medication can be pushed under pressure using a smaller shorter needle. When a higher 30 gauge needle is used, with a 3 ml syringe, the distance of travel of medication from the syringe and needle into tissue will be greater, because there is increased velocity through the smaller needle and hence greater penetration of medication into the tissues.

From practical experience we know that the velocity of fluid through the small area is larger than the velocity of the fluid through the large area. This phenomenon can be explained and quantified by examining the flow rate of mass through a tubing. Because no fluid can leave through the walls and there are no "sources" or "sinks" wherein the fluid can be created or destroyed, the mass crossing each section of the tube per unit time must be the same. This is simply the principle of conservation of mass. This principle is embodied in the equation of continuity which states that, in any steady state process, the rate at which mass enters a system is equal to the rate at which mass leaves the system.

Flow rate through A1 = Flow Rate through A2
d1A1V1 = d2A2V2
therefore dAV = constant

This equation expresses the law of conservation of mass in fluid dynamics.
If fluid is incompressible, then the density is constant (d1 = d2),
Then,
A1V1 = A2V2
where A1= Area in tube 1 V1= Velocity in tube 1 A2= Area in tube 2 V2= Velocity in tube 2 d = density of the fluid

For our purpose, A1V1 will be a syringe and A2V2 the hypodermic needle. When a higher gauge (smaller) needle is used, with a 3 ml syringe, the distance of travel of medication from the syringe and needle into tissue will be greater, because there is increased velocity through the smaller needle and hence greater penetration of medication into the tissues.
We can derive that the smaller inner diameter of the needle, results in more than double the velocity through the needle and thus greater penetration in to the tissues when compared to the larger bore needle, i.e. 2966 m/s using a 30 G needle with a 3 mL syringe when compared to 1111.3 using a 25 G needle and a 3mL syringe as calculated above. Therefore, the smaller the needle bore, the higher the pressure and the greater the distance traveled by medication into tissue.This equation and application apply only to injections under pressure of clear solution

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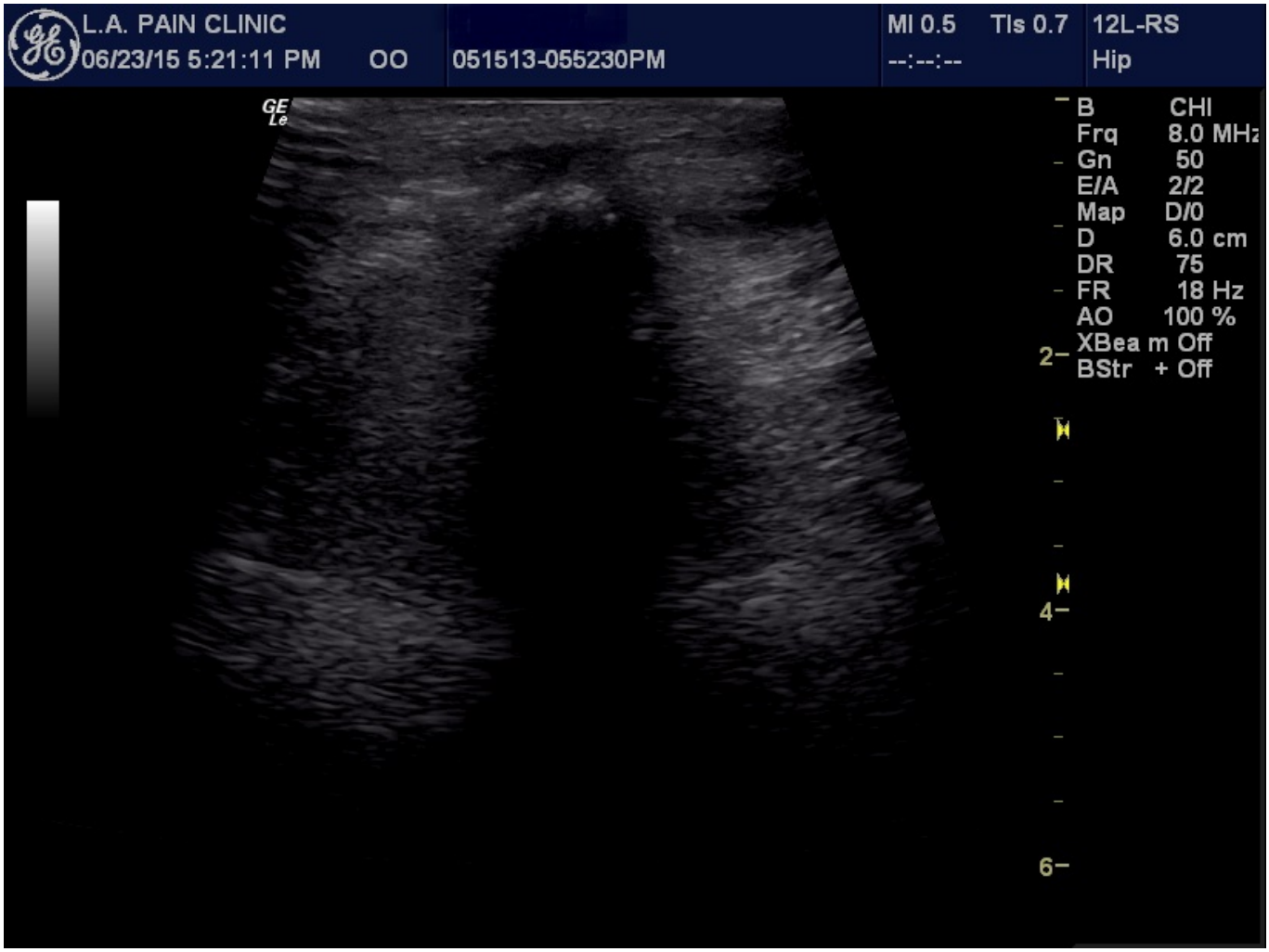

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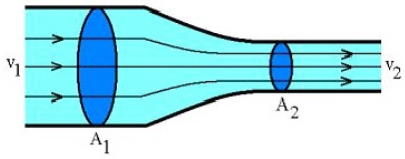
Figure 8



Flow rate through A_1 = *Flow rate through* A_2

$$d_1 A_1 v_1 = d_2 A_2 v_2$$

Therefore,

$dAv = Constant$

This equation expresses the law of conservation of mass in fluid dynamics.

If fluid is incompressible, then the density is constant ($d_1 = d_2$),

Then,

$A_1 v_1 = A_2 v_2$ .....Equation 2

where A1= Area in tube 1

V1= Velocity in tube 1

A2= Area in tube 2

V2= Velocity in tube 2

d = density of the fluid

For our purpose, A1V1 will be a syringe and A2V2 the hypodermic needle. When a higher gauge (smaller) needle is used, with a 3 ml syringe, the distance of travel of medication from the syringe and needle into tissue will be greater, because there is increased velocity through the smaller needle and hence greater penetration of medication into the tissues.

(https://files.aievolution.com/ars1901/abstracts/abs_2516/Fig8-LawofConservationofMass.jpg)

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The study was approved by the appropriate IRB or other local review board.

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