Potential Advantages of the Accelerated Seldinger Technique

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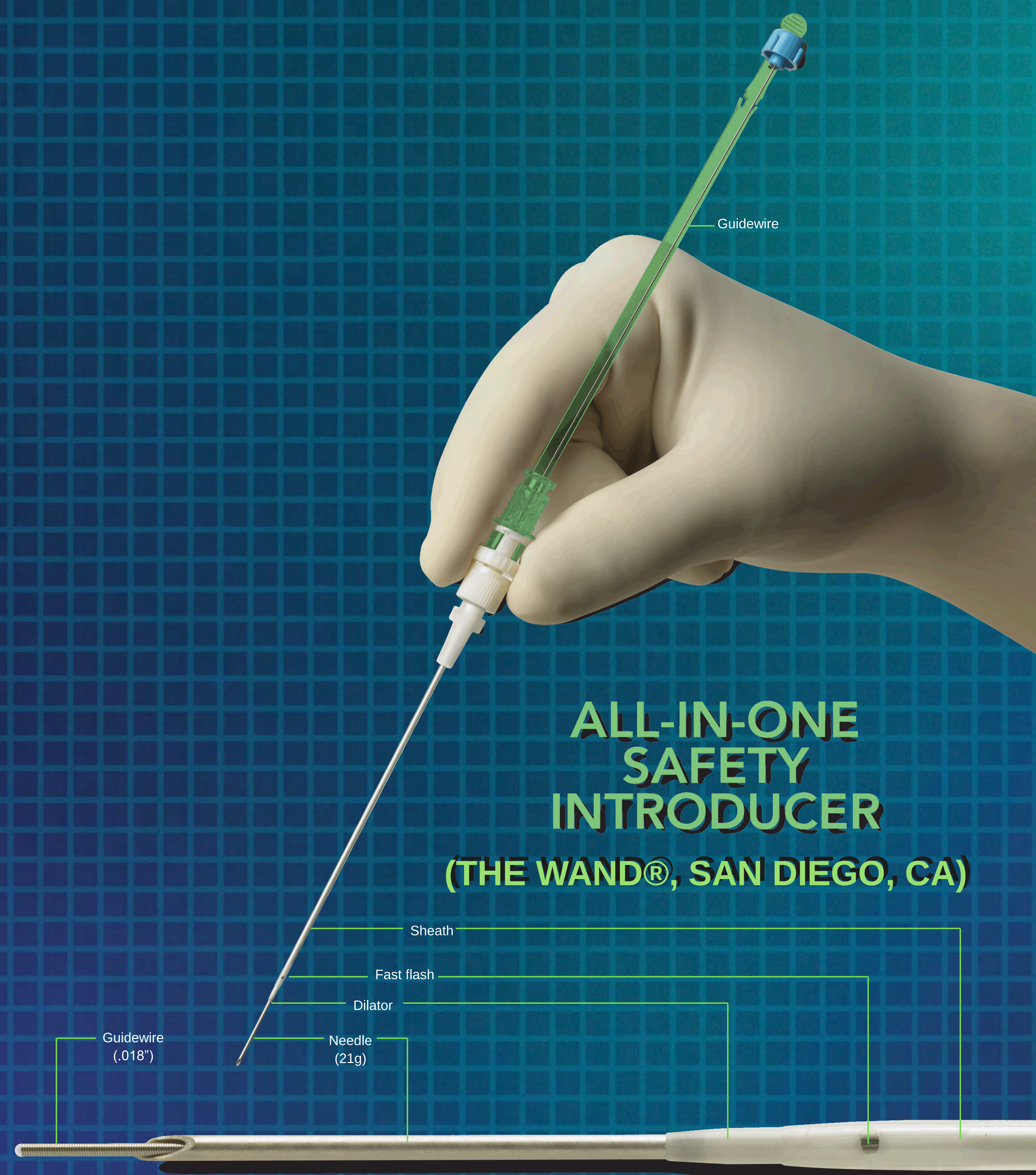
PURPOSE: To determine whether the Accelerated Seldinger Technique (AST) is faster and safer than the Modified Seldinger Technique (MST).

INTRODUCTION: MST entails certain risks. For example, MST includes 2 “open-to-air” events, during which bleeding, contamination and/or air embolism can occur.[1] Further, an active safety needle is prone to mechanical malfunction or operator error. Finally, MST is a relatively complicated process during which vessel cannulation can be lost.

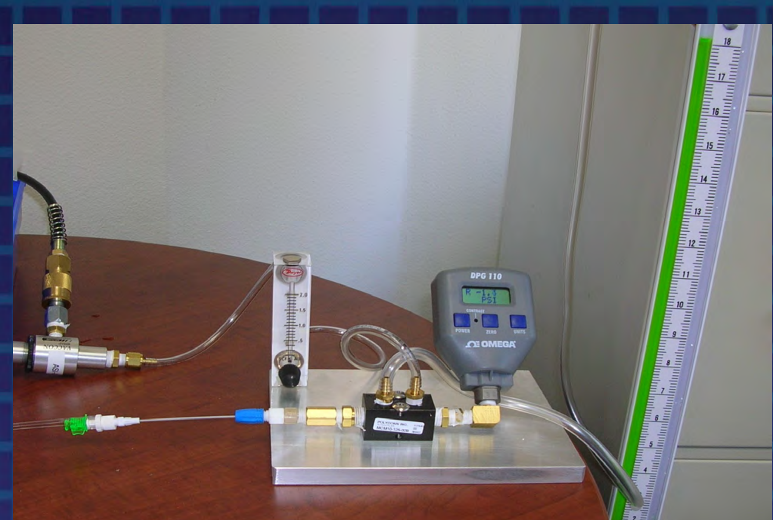
The Accelerated Seldinger Technique is designed to offer passive needlestick safety and a faster, more efficient over-wire approach to catheterization. The present pilot study—using simple, reliable bench-tests—was conducted to assess the advantages of AST over MST.



I. AIR EMBOLISM “OPEN-TO-AIR” EVENTS

DEFINITION: “OPEN-TO-AIR” EVENT

A circumstance during which there exists unobstructed communication between the outside atmosphere and the intravascular space.



METHOD 1: An air-tight seal was placed over the distal portion of the MST and AST device using a collet, and a vacuum was applied through a manifold using a venturi-type vacuum pump. Flow rates were then assessed within the manifold using a flow meter. Suction pressures were assessed by means of a manometer (see photograph).

Table 1

	MST Needle		AST Device	
Sample No.	Vacuum (cm H_2O)	Flowrate (cc/sec)	Vacuum (cm H_2O)	Flowrate (cc/sec)
1	16.5	3.54	16.5	No measurable amount
2	16.5	3.54	16.5	No measurable amount
3	16.5	3.54	16.5	No measurable amount
4	16.5	3.54	16.5	No measurable amount
5	16.5	3.54	16.5	No measurable amount
6	16.5	3.54	16.5	No measurable amount

Table 2

MODIFIED SELDINGER TECHNIQUE[1]	ACCELERATED SELDINGER TECHNIQUE
1. Preparation a. Prep area of anticipated vessel access per hospital policy and procedures. b. **OPTIONAL**: Administer local anesthetic. c. Use aseptic technique throughout entire procedure.	**Same.**
2. Remove components from packaging and place on sterile field.	**Same.** Remove device and place on sterile field.
3. **OPTIONAL**: Make skin nick over target vessel with scalpel.	**Same.**
4. **OPTIONAL**: In hypovolemic patients and patients in shock, attach syringe to needle hub.	
5. Remove needle guard from needle.	**Same.**
6. Access vessel with introducer needle and confirm intraluminal placement by observing blood in needle hub. **OPEN-TO-AIR**	**Same.** Plus 2 (two) early indicators a. Blood in the dilator/needle fenestration ‘window’. b. Observation of advancing blood column between transparent sheath and dilator, i.e. ‘fast flash’.
7. Once access is confirmed, (remove syringe if present, and…) occlude needle lumen immediately to prevent air embolism or bleeding.	**NOT NECESSARY.** Guidewire already in place.
8. Obtain guidewire and thread into needle hub.	**NOT NECCESARY.** Guidewire already in place.
9. Advance guidewire through needle into vessel.	**Same**
10. Hold guidewire in place and remove needle.	**NOT NECESSARY.** Guidewire cap snaps securely on needle hub.
11. Dispose of needle immediately in appropriate biohazard container.	**NOT APPLICABLE**
12. **OPTIONAL**: If not already done, make a skin nick over target vessel with scalpel being careful to direct cutting edge of scalpel away from guidewire.	**Same.**
13. Obtain a dilator/sheath (coaxially mounted).	**NOT NECESSARY.** The WAND comes with components preassembled.
14. Thread dilator/sheath over guidewire	**NOT NECESSARY**
15. Advance dilator/sheath into vessel.	**Same.** This action passively locks the needle hub to track and needle tip in dilator.
16. Remove dilator and guidewire leaving sheath in vessel. **OPEN-TO-AIR**	Once dilator/sheath are in vessel, the guidewire, needle and dilator are removed as a unit. **OPEN-TO-AIR**
17. Occlude sheath lumen immediately to prevent air embolism or bleeding.	**Same.**

II. NEEDLESTICK SAFETY

Table 3

Sample No.	Peak Force (N)	Needle Exposed?	Needle Lock Failure?	Observations	Sample No.	Peak Force (N)	Needle Exposed?	Needle Lock Failure?	Observations
1	6.450	No	No	Needle/Dilator bent at junction with dilator hub	19	7.784	No	No	Needle/Dilator bent at junction with dilator hub
2	10.453	No	No	Needle/Dilator bent at junction with dilator hub	20	13.567	No	No	Needle/Dilator bent at junction with dilator hub
3	16.014	No	No	Needle/Dilator bent at junction with dilator hub	21	10.008	No	No	Needle/Dilator bent at junction with dilator hub
4	5.783	No	No	Needle/Dilator bent at junction with dilator hub	22	3.336	No	No	Needle/Dilator bent at junction with dilator hub
5	10.453	No	No	Needle/Dilator bent at junction with dilator hub	23	6.228	No	No	Needle/Dilator bent at junction with dilator hub
6	13.789	No	No	Needle/Dilator bent at junction with dilator hub	24	9.564	No	No	Needle/Dilator bent at junction with dilator hub
7	12.010	No	No	Needle/Dilator bent at junction with dilator hub	25	9.564	No	No	Needle/Dilator bent at junction with dilator hub
8	7.562	No	No	Needle/Dilator bent at junction with dilator hub	26	7.340	No	No	Needle/Dilator bent at junction with dilator hub
9	6.450	No	No	Dilator skived, but no exposed needle	27	9.786	No	No	Needle/Dilator bent at junction with dilator hub
10	7.784	No	No	Needle/Dilator bent at junction with dilator hub	28	5.115	No	No	Needle/Dilator bent at junction with dilator hub
11	10.676	No	No	Needle/Dilator bent at junction with dilator hub	29	7.562	No	No	Needle/Dilator bent at junction with dilator hub
12	11.788	No	No	Needle/Dilator bent at junction with dilator hub	30	8.229	No	No	Small break in dilator guidewire visible beaneath, no exposed needle or visible
13	12.010	No	No	Needle/Dilator bent at junction with dilator hub	31	4.671	No	No	Needle/Dilator bent at junction with dilator hub
14	9.119	No	No	Needle/Dilator bent at junction with dilator hub	32	4.893	No	No	Needle/Dilator bent at junction with dilator hub
15	11.121	No	No	Needle/Dilator bent at junction with dilator hub	33	11.343	No	No	Needle/Dilator bent at junction with dilator hub
16	8.674	No	No	Small break in dilator at bend, no exposed needle	34	5.560	No	No	Needle/Dilator bent at junction with dilator hub
17	5.783	No	No	Needle/Dilator bent at junction with dilator hub	35	5.115	No	No	Needle/Dilator bent at junction with dilator hub
18	3.559	No	No	Needle/Dilator bent at junction with dilator hub					

Statistical Summary			
Min	3.336	Mean	8.547
Max	16.014	StDev	3.079

METHOD 2: The passive needlestick safety features of 30 AST devices were first activated and then manually driven into a plate, with maximum force. Digital readouts of load cell compression were sequentially recorded.

III. SPEED TO ACCESS

MST vs. AST

METHOD 3: Six MST and six AST cannulation procedures were performed by the same operator on a vein simulator (VATA, Oregon City, OR). Conditions were ideal: fluorescent lights and sunlight, all components readily at hand, average venous pressure constant. Times were recorded beginning with first flash of blood and concluding with final removal of guidewire and dilator.

Table 4

Procedure Device	Modified Seldinger (sec) Cook 4Fr MicroPuncture Introducer Kit	Accelerated Seldinger (sec) The Wand, 4 Fr MicroAccess Introducer
Training Unit	38.72	18.00
1	39.13	13.50
2	41.72	14.53
3	36.00	10.06
4	42.66	10.34
5	38.75	10.84
6	34.69	9.31
Mean	**38.83**	**11.43**
StDev	3.11	2.09

CONCLUSION: This pilot study is a non-clinical, bench-test, risk assessment comparing MST with AST. Table 2 demonstrates that there is a 50% reduction in “open-to-air” events with AST. Table 1 demonstrates conclusively that even at -16.5cm H_20—the maximum negative pressure an adult human can generate—there is no measurable flow through the AST needle with the guidewire in place.[3, 4, 5] Thus, AST appears safer with respect to risk of air embolism as well as bleeding and contamination.

Passive needlestick safety is safer than active needlestick safety because it eliminates the risk of operator error. Mechanically, however, a passive needlestick safety mechanism could still fail. The AST passive safety mechanism was rigorously challenged against a hard surface at much higher forces than would be generated in the normal clinical setting: There were no mechanical failures. The AST passive needlestick safety mechanism appears fail-safe.

The conditions under which the speed of MST was compared with AST were ideal, and therefore highly favorable to MST. In the clinical setting, lighting is rarely perfect; and MST components are often laid out so that one must turn and reach for them—resulting, not uncommonly, in lost cannulation. Nevertheless, under the ideal conditions of this study, AST was more than 3 times faster than MST.

This pilot study strongly suggests that AST may be faster and safer than MST. Clearly, a large-scale clinical trial is now needed.

References:

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