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## Trauma Ultrasound and the 2005 Cochrane Review

### To the Editor:

In the March 2007 issue of *Annals*, Dr. Steven Vance wrote a systematic review abstract summarizing the 2005 Cochrane review of emergency ultrasound-based algorithms for diagnosing blunt abdominal trauma. The authors of the Cochrane review concluded that there was no statistically significant difference in the use of computed tomography, use of diagnostic peritoneal lavage or laparotomy rate between patients who received ultrasound and those who did not.<sup>1</sup> However, the Cochrane review was flawed by statistical errors as well as inclusion of a questionable study.<sup>2-5</sup> When calculating the risk differences in the use of computed tomography and diagnostic peritoneal lavage between subjects who received ultrasound and subjects who did not, the authors of the Cochrane review mistakenly switched the denominators in the Boulanger study. For example, the Cochrane reviewers concluded that although ultrasound reduced the risk of computed tomography use by 46%, it was not statistically significant (95% confidence interval [CI] includes zero). However, with correct numbers from the Boulanger study,<sup>2</sup> ultrasound significantly reduces the risk of computed tomography use by 62% (95% CI: (-0.86, -0.39) (Table 1). In addition, the Cochrane analysis included a study by Navarrete-Navarro<sup>3</sup> that is not relevant because the authors primarily studied the effect of computed tomography use in trauma. In this study, the majority of subjects (57%)

in the "ultrasound group" never received an abdominal ultrasound but the Cochrane review assumed all subjects did. For use of diagnostic peritoneal lavage, with corrected numbers (from the Boulanger study) and the elimination of the Navarrete-Navarro study, ultrasound is associated with a 6% risk reduction (95% CI: (-0.09, -0.02) (Table 2).

The authors also concluded that the use of trauma ultrasound had no effect on the laparotomy rate but they did not explain the rationale for why it would. The studies analyzed by the Cochrane group<sup>2,5</sup> were predicting the need of patients for laparotomy. Theoretically, trauma ultrasound may reduce the laparotomy rate by decreasing diagnostic time and thus increasing the number of eligible patients for angioembolization. Unfortunately, the studies providing the laparotomy data in the Cochrane analysis did not have the option of angioembolization for blunt splenic injury.<sup>2,5</sup> Thus, it does not seem reasonable to expect that ultrasound should decrease the laparotomy rate when looking at the studies in the 2005 Cochrane review. Moreover, the fact that trauma ultrasound significantly reduced the use of computed tomography and diagnostic peritoneal lavage while not increasing the laparotomy rate is never mentioned.

In summary, the Cochrane review of trauma ultrasound was methodologically flawed. While we agree with Dr. Vance that more rigorous studies are needed to determine the full impact of ultrasound on patient outcomes, the data clearly shows significant reductions in both computed tomography and diagnostic peritoneal lavage use when ultrasound is included in trauma algorithms.

**Table 1.** Comparison of risk difference estimates in use of computed tomography when incorrect versus correct numbers are used.

Study	Original Cochrane Numbers and Estimates				Correct Numbers and Estimates			
	Ultrasound n/N	No Ultrasound n/N	Risk Difference (95% CI)		Ultrasound n/N	No Ultrasound n/N	Risk Difference (95% CI)	
Arrillaga	9/105	223/226	-0.90	(-0.96,-0.85)	9/105	223/226	-0.90	(-0.96,-0.85)
Boulanger	111/246	225/460	-0.04	(-0.12,0.04)	111/ <b>460</b>	225/ <b>246</b>	-0.67	(-0.73,-0.62)
Navarrete-Navarro	14/51	52/52	-0.73	(-0.85,-0.60)	14/51	52/52	-0.73	(-0.85,-0.60)
Rose	37/104	54/104	-0.16	(-0.30,0.03)	37/104	54/104	-0.16	(-0.30,0.03)
Total	171/506(34%)	554/842(66%)	-0.46	(-1.04,0.13)	171/720(24%)	554/628(88%)	-0.62,	(-0.86,-0.39)
<b>*Total (Without Navarrete-Navarro)</b>					<b>157/669 (23%)</b>	<b>502/576(87%)</b>	<b>-0.59,</b>	<b>(-0.88,-0.29)</b>

Correct numbers from the original studies are bolded in the table.

**Table 2.** Comparison of risk difference estimates in use of diagnostic peritoneal lavage when incorrect versus correct numbers are used.

Study	Original Cochrane Numbers and Estimates				Corrected Numbers and Estimates			
	Ultrasound n/N	No Ultrasound n/N	Risk Difference (95% CI)		Ultrasound n/N	No Ultrasound n/N	Risk Difference (95% CI)	
Arrillaga	3/105	15/226	-0.04	(-0.08,0.01)	3/105	15/226	-0.04	(-0.08,0.01)
Boulanger	5/246	21/460	-0.03	(-0.05,0.00)	5/ <b>460</b>	21/ <b>246</b>	-0.07	(-0.11,-0.04)
Navarrete-Navarro	31/51	5/52	0.51	(0.36,0.67)	31/51	5/52	0.51	(0.36,0.67)
Total	39/402(10%)	41/738(6%)	0.12	(-.04,0.28)	39/616 (6%)	41/524 (8%)	0.10,	(-0.07,0.27)
<b>*Total (Without Navarrete-Navarro)</b>					<b>8/565(1%)</b>	<b>36/472(8%)</b>	<b>-0.06,</b>	<b>(-0.09,-0.02)</b>

Correct numbers from the original studies are bolded in the table.

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In reply:

I would like to take this opportunity to thank the authors for their thorough analysis of the Cochrane database in regards to the review by Stengel et al entitled *Emergency Ultrasound-Based Algorithms for Diagnosing Blunt Abdominal Trauma*. Since receiving their letter, I have reviewed both the initial study by Boulanger et al, as well as the systematic review and indeed, the denominators were switched. In summarizing the review, I must admit that I did not detect this error. With this correction, the data does suggest a statistically significant decrease in computed tomographic usage. The statistically significant decrease in diagnostic peritoneal lavage is also noted, although somewhat expected, given the fact that the Focused Assessment with Sonography for Trauma (FAST) exam has largely replaced diagnostic peritoneal lavage in practice.

I would, however, like to reiterate my concern regarding decreased computed tomographic usage as a key outcome marker. Although many studies have reported this data, our clinical practice in the United States has been to use ultrasound as an adjunct to the primary trauma survey. Ideally, the FAST exam helps physicians to rapidly assess for the site of hemorrhage in a hemodynamically unstable patient and to expedite appropriate disposition based on the ultrasound findings. Clearly, the unstable patient with a positive FAST