Diagnosis Teaching Package Answers and Teaching Tips

Diagnosis Teaching Package Example: Answers

Clinical Question:

What is the accuracy of clinical assessment and ultrasound for the diagnosis of suspected deep vein thrombosis (DVT)?

Population: Patients with suspected DVT
Intervention: clinical exam and also ultrasound
Comparison: The Gold Standard for diagnosis of DVT: contrast venography
Type of study you would love to find: a prospective trial in which there is a comparison of the tests we care about (clinical exam and ultrasound) to the gold standard for diagnosing DVT (contrast venography)

The Medline search:

Database: Medline 1966 to present
Search Engine Used: OVID
Terms:
The first term you enter is deep vein thrombosis, however this is not a mesh heading. Your search engine will offer you a number of related choices of which you pick: **Thrombosis** or **Venous Thrombosis** as the Mesh headings closest to what you are looking for. You do NOT explode thrombosis because several of the terms underneath in the Mesh heading tree are not relevant to your search (e.g. hepatic vein thrombosis and retinal vein occlusion)

Because what you care about is the diagnosis (**di**) of DVT using ultrasound (**us**) you search for these as floating subheadings (**fs**). You can also apply a methodologic filter for finding articles about diagnostic tests (looking for articles about **sensitivity and specificity** and **predictive value**). Next, you want to look for **prospective studies**. Finally, you can limit your set to **human** studies in the **English** Language.

Your search will look something like this:

1	Thrombosis/ or Venous thrombosis/	30,865
2	(di or us).fs.	971,883
3	1 and 2	5,903
4	exp sensitivity-and-specificity	81,350
5	(predictive and value:).tw.	22,686
6	4 or 5	94,491
7	3 and 6	237
8	Prospective studies/	114,291
9	7 and 8	50
10	limit to (human and English)	46

You scan the abstracts, selecting those that are about diagnosis of DVT using clinical exam and ultrasound. You pick the article by Wells et al. because it seems to most directly answer your question and to be methodologically valid (although it is sometimes hard to tell by the abstract).

Discussion of Pretest Probabilities:

You can not discuss a diagnostic test without discussing pretest probability. You might engage your learners by having them “guess-timate” the probability of disease in the case presented and then compare the various assessments. This is a common stumbling block as learners are often uncomfortable with estimating the probabilities. Having people write down his or her assessments on a small piece of paper (secret ballot) will minimize the ‘herd’ effect of everyone guessing the same value. Set aside these estimates to use later after you have calculated some likelihood ratios. You may also want to vary the scenario to create a picture that is very different (much more or less likely to have the disease in question) so that you can most effectively show how pre-test probability interacts with the likelihood ratio.

The Critical Appraisal Exercise:

Questions	***Accuracy of clinical assessment of deep-vein thrombosis*** **(Lancet, 1995; 345: 1326-30)**
Are the Results Valid?	
Reference Standard **Was there an independent "blind" comparison with a reference standard?**	All patients underwent a 3 step process: 1. Clinical model applied to estimate pre-test probability. 2. Ultrasound 3. Venography on the same day, if possible. If not, it was done the following day (Reference Standard) US and venogram reports were interpreted by a panel of 3 or more observers blinded to the diagnostic test results or patient history. Discussion and consensus resolved disagreements.
Spectrum of patients studied **Did the patient sample include an appropriate spectrum for whom the test will be applied in clinical practice?**	Possibly. The patients are outpatients referred to three centers for evaluation of suspected DVT. Hospitals were university-affiliated centers in Canada and Italy. Exclusion criteria: previous DVT or PE, suspected PE at presentation, inability to take contrast, anticoagulation for >48h, below the knee amputation and pregnancy. Inclusion criteria: outpatients with suspected DVT for <60 days Because this is a population referred to a set of university associated medical centers, there may be referral bias, diagnostic work up bias and/or diagnostic suspicious bias. All of these biases will favor a population more enriched with the disease and, perhaps more likely to have a positive ultrasound. (The end result of having more people who will test positive → overestimate of sensitivity and underestimate of specificity.)
Performance of Reference Standard **Was the reference standard performed in all cases or did the result of the test being evaluated influence the decision to perform the reference standard?**	Yes. Venograms were done on all subjects, regardless of any clinical history, physical findings or ultrasound reports.
Description of Methodology **Were the methods of the test described in sufficient detail to permit replication?**	Yes. The investigators used standard methods for doing each of the tests described and cited papers, which describe these methods in detail.

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Questions	***Accuracy of clinical assessment of deep-vein thrombosis*** **(Lancet, 1995; 345: 1326-30)**
What are the Results?	*Overall Prevalence of DVT in all study patients* Of 529 patients, 135 had DVT (26%) Of these 113 had proximal DVT (21%) *Prevalence of DVT according to subgroups determined by the clinical model:* High pre-test probability 85% Moderate pre-test probability 33% Low pre-test probability 5%
What were the Likelihood ratios?	*(See Worksheets attached)* Clinical Exam: We can use clinical criteria as a diagnostic test to stratify patients into categories of high (LR 16.2), moderate (LR 1.5) and low probability (LR 0.17). For patients in the moderate probability category, we gain no valuable diagnostic information and we must go on to a second test (e.g. venography). Ultrasound: In many patients an ultrasound will greatly modify our pre-test probabilities. A negative US will virtually rule out DVT (LR- 0.22) whereas if it is positive it is virtually diagnostic for DVT (LR+=39). The properties of the test are even better for evaluation of proximal DVT (LR+ =44.5; LR-=0.11)
Will the Results help me in caring for my patients?	
Will the reproducibility of the test result and its interpretation be satisfactory in my setting?	Probably yes. Both Doppler ultrasonography and venography are tests that require consistency and skill in both performance and interpretation. However, it does seem that the criteria applied for both abnormal ultrasound (lack of full compressibility) and abnormal venogram (constant luminal filling defect in at least 2 projections) are appropriate and accepted standards. It is likely that these results could be reproduced at university-affilitated centers, such as those involved in the study. However, possibly at smaller centers, there may be less experience with these procedures and the results and interpretation may be more variable.
Are the results applicable to my patient?	Yes. My patient presented to the ER of a university-affilitated hospital and was sick enough to be admitted to the hospital. Unfortunately, there is no description of patient demographics to define the racial, gender or socioeconomic make up of the group studied. We do know that the centers spanned 2 countries (Canada and Italy) and that the DVT frequencies varied from institution to institution. The implication is that there may be important differences in diverse populations of patients.

Will the results change my management?	Yes, definitely. The clinician will certainly take different actions depending on whether the diagnosis of DVT is confirmed, ruled out or remains in doubt. Specifically, the clinician will need to decide whether or not to anticoagulate the patient. When clinical exam and ultrasound agree (high pretest probability and + US or low pretest probability and –US) we will effectively rule in or rule out disease. Clinicians can feel comfortable making decisions about anticoagulation on this basis alone. When clinical examination and ultrasound are in disagreement (high pre-test probability and –US or low pre-test probability and +US), additional testing such as venogram might be necessary.
Will patients be better off as a result of the test?	Yes, definitely. The combination of clinical exam and ultrasound provides a safe, non-interventional way of confirming or excluding DVT. This is essential in the treatment of disease and in prevention of migration of the clot (e.g. to prevent pulmonary embolism). This combination of tests is far safer than the gold standard, venogram.

ANSWERS Worksheet I: Calculating the LR for the Clinical Model for evaluation of DVT

(Numbers taken from table 2 by adding up the numbers of outcomes and patients in each group)

Clinical Model	DVT Present by Venogram	proportion of patients with DVT	DVT absent by Venogram	Proportion of patients without DVT	Likelihood Ratio
High prob	72	72/135 = 0.533	13	13/394=0.33	0.53/0.033=16.2
Moderate prob	47	47/135=0.35	96	96/394=0.24	0.35/0.24=1.5
Low prob	16	16/135=0.12	285	285/394=0.72	0.12/0.72=0.17
	135		394		

ANSWERS Worksheet II: Calculating the LR for the US for evaluation of DVT

Using numbers from table 3 on page 1328, please complete the following 2x2 table:

Combined Groups For **Proximal DVT**

	(+) DVT	(-) DVT	
(+) US	92	7	
(-) US	11	346	
	103	353	456

Combined Groups For **ALL DVT**

	(+) DVT	(-) DVT	
(+) US	94	7	
(-) US	27	346	
	121	353	474

For Combined Groups calculate the likelihood ratio for determining **Proximal DVT** using Ultrasound:

Ultrasound Result	(+)DVT present	Proportion	(-)NO DVT	Proportion	Likelihood Ratio (L1/L2)
(+) US	92	92/103 =0.89	7	7/353= 0.020	LR(+)= 0.89/0.02 = 44.5
(-) US	11	11/103 =0.11	346	346/353=0.98	LR (-) = 0.11/0.98 =0.11

For Combined Groups calculate the likelihood ratio for determining **All DVT** using Ultrasound:

Ultrasound	(+)DVT	Likelihood 1	(-)NO DVT	Likelihood 2	Likelihood Ratio (L1/L2)
(+) US	94	94/121 =0.78	7	7/353= .020	LR(+)= .78/.02 = 39
(-) US	27	27/121=0.22	346	346/353=.98	LR (-) = .22/.98 = 0.22

ANSWERS: Extra Practice- Likelihood Ratios from Table 3:

You can use the Sensitivities and Specificities in Table 3 on page 1328 to derive the following likelihood ratios for extra practice. For those of you who like formulas, you can convert directly to LR(+) and LR(-) using :

positive likelihood ratio = sensitivity / (1-specificity)
negative likelihood ratio = (1-sensitivity)/specificity

Pre-Test Probability (Derived by Clinical Model)	Likelihood Ratios for Proximal DVT		Likelihood Ratios for All DVT	
	LR(+)	LR(-)	LR (+)	LR (-)
High Risk	So very high*	0.06	So very high*	0.09
Moderate Risk	83	.17	61	.39
Low Risk	40	0.2	33.5	0.34
All Groups Combined	44.5	0.11	39	0.22

*because the specificity was 100% (i.e. there no false + tests), you can only calculate the LR+ if you consider the confidence interval around zero and use a number other than 0.

Warnings:

1. You can use these formulas only if you are looking at a dichotomous test (Positive or Negative).
2. From a teaching perspective, it does not show your learners what a likelihood ratio really means- it is simply a formula that they will likely forget when they need it!

Comments on the Clinical Scenario and teaching tips:

1. The patient in the scenario falls into the Moderate Probability Category from Table 1 on p 1328. He has 2 Major points (paresis and swollen calf and thigh) but no minor points. Clinical Examination for patients in this category is not a useful diagnostic test (LR=1.5). Thus, you need to get an ultrasound in order to diagnose or exclude a diagnosis of DVT.
2. Calculating the LR for US in the diagnosis of suspected DVT shows you that US is a very good test (LR (+) $\geq$ 40 and LR(-) $\leq$ 0.2 for proximal DVT) and it will help us make our diagnosis. However the radiologist in the scenario forces you to address the next question. What will you do with the information when you get it?
3. Be very careful about timing when teaching diagnostic testing. It takes learners a long time to go through the transformation of the data into likelihood ratios. You may need to only quickly review the validity criteria so that you can focus your energy on the case, the results section and how you will use likelihood ratios to make the clinical decisions.
4. It is very effective to always begin with a 3x2 table such as the Clinical model which has 3 possible results (High, moderate and low probability). This forces the teaching point that you <u>can not</u> calculate sensitivity and specificity in this setting. (Another good paper for teaching this is Pioped, which gives you the three possible outcomes of High, Intermediate, and Low probability VQ scans.)

Resolution of the Clinical Scenario:

The team decided that we would not be willing to anticoagulate this patient without greater certainty as to the diagnosis of DVT. In addition, we considered the other possible option of placing a greenfield filter to prevent PE, if the patient's hematocrit dropped further and we could not anticoagulate him. We got an interventional vascular radiologist to agree that she would place the filter if the US revealed clot and if the patient could not be anticoagulated. Armed with this information, we made a final call to the on-call chief of radiology. He agreed to send someone in to perform the ultrasound that evening. The ultrasound was negative, ruling out a DVT.