Effectiveness of practices to reduce blood sample hemolysis in EDs: A laboratory medicine best practices systematic review and meta-analysis

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Present by 陳秀鉛
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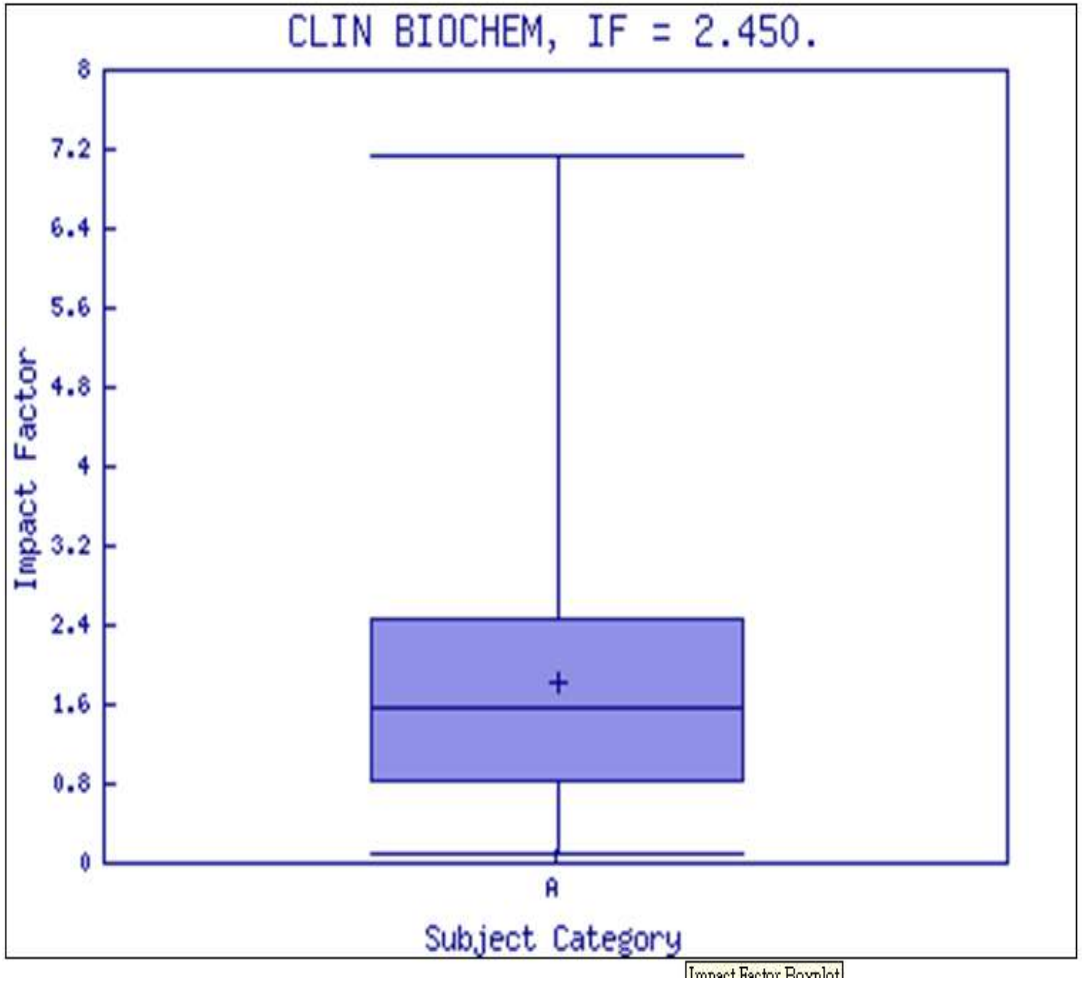
Clinical Biochemistry

Category Box Plot

For **2012**, the journal **CLINICAL BIOCHEMISTRY** has a Impact Factor of **2.450**.

This is a box plot of the subject category or categories to which the journal has been assigned. It provides information about the distribution of journals based on Impact Factor values. It shows median, 25th and 75th percentiles, and the extreme values of the distribution.



Key

A - MEDICAL LABORATORY TECHNOLOGY

本院檢體退件原因

退件原因統計表(102年度)-6月

原因	生化	血清	細菌	鏡檢	血液	血庫	TOTAL
Clot	39	1	0	0	100	0	140
未用血庫專用標籤	0	0	0	0	0	3	3
TDM檢查資料(時間)	1	0	0	0	0	0	1
要求重測	21	0	0	0	15	0	36
缺檢驗單	0	0	1	0	3	0	4
缺檢體	10	1	1	0	5	0	17
基本資料不符	1	1	2	1	4	0	9
採檢日與醫令不合	1	0	0	0	0	0	1
採檢容器不符	0	0	2	1	0	0	3
溶血	82	1	0	0	33	0	116
檢驗單未標示檢體種類	0	0	0	7	0	0	7
檢驗單未簽採檢者及採檢時間	0	0	2	25	0	0	27
檢驗單有問題，不能簽	0	0	1	2	0	0	3
檢體不足	2	2	0	37	2	0	43
檢體比例不合	0	0	0	1	1	0	2
檢體汙染，重新送檢	1	0	0	6	0	0	7
檢體無標示採檢日期/時間	0	0	0	0	0	6	6
檢體與檢驗單不符	0	1	9	7	1	0	18
備血沒double sign	0	0	0	0	0	3	3
醫師沒簽章	1	0	0	0	0	0	1
合計	159	7	18	87	164	12	447

單 位溶血件數

溶血統計

	6A	6B	7A	7B	8A	8B	9A	9B	10A	10B	11A	11B	12A	12B	13B	BR	BU	DR	ER	RCC	HDR	ICU-1	NB
102.1	1	9	5	9	8	8	7	3	6	3	8	1	0	2	0	0	0	2	39	1	0	19	0
102.2	5	3	6	1	5	3	5	3	8	5	3	11	0	2	0	0	0	0	29	1	0	11	0
102.3	4	3	4	2	4	6	2	7	6	5	9	9	0	0	2	0	0	1	22	0	0	9	0
102.4	3	1	5	7	12	4	5	10	8	6	3	4	0	0	0	0	0	0	23	1	0	11	0
102.5	0	15	8	4	16	8	4	7	16	3	10	12	0	0	1	0	0	2	35	1	0	24	0
102.6	9	4	1	2	8	3	8	3	9	4	8	10	0	0	2	0	0	2	27	0	0	11	0
102.7																							
102.8																							
102.9																							
102.10																							
102.11																							
102.12																							
平均	3.7	5.8	4.8	4.2	8.8	5.3	5.2	5.5	8.8	4.3	6.8	7.8	0.0	0.7	0.8	0.0	0.0	1.2	29.2	0.7	0.0	14.2	0.0

說明及改善

文件編號	制定單位	名　　稱	頁數/總頁數	/
P6100182	實驗診斷科	實驗診斷科採檢手冊	版本	102-02H

♣造成溶血的可能原因:

在過去的時間裡大部份可能的原因:

1. 採血者技術不佳
2. 未拔去空針針頭,直接將血液吸入真空採血管
3. 病人血管難抽
4. 病人本身就有溶血傾向所造成
5. 其他意外,如檢體受到劇烈震盪，重摔，離心不平衡所引起
6. 所採用的試管品質有問題

可能原因	建議方法
固定不良 ， 過過度搖晃而使組織或血球受傷	解開止血帶拔出針頭 ,另外再找部位 另外再找部位 另外再找部位 另外再找部位 ,重新靜脈採血
太用力混合檢體	血液與添加劑混合不能太劇烈
抽血不足 ,血液及添加物比例不正確	依標準維持抽血量和添加劑的一定比
注射針筒直接穿刺採血管分裝檢體	先移除注射針 ,再將採血管蓋打開 ,而後才利用針筒來分裝檢體
清潔消毒用的酒精太溼所造成汙染	酒精消毒後,應待抽血部位自然乾燥後 ,再予以穿刺,或酒精棉球泡的剛好 或,用手 擠壓不會有液體流出或拔針時用乾棉壓住抽血處
止血帶緊綁超過兩分鐘	先鬆開止血帶一會兒,再重新綁止血帶 抽血

Introduction

- When blood samples are hemolyzed they can produce **unreliable laboratory results**.
  - ✓ Hemolysis may interfere with bilirubin determination, which, in turn, may affect the accuracy of plasma bilirubin measurements in preventing the occurrence of neonatal kernicterus.
  - ✓ Potassium results from hemolyzed samples may falsely indicate disguise a life-threatening abnormality and lead to inappropriate treatment
- When blood samples are hemolyzed, **a new clinical sample is often required.**
  - ✓ It has been recognized that re-collection of hemolyzed blood samples may delay patient care.

Introduction

- Despite these problems, hemolyzed blood samples are frequently received in clinical laboratories, comprising as much as 3.3% of all routine samples and accounting for up to 40%–70% of all unsuitable samples identified — nearly five times higher than other causes, such as insufficient, incorrect, and clotted samples .
- The American Society for Clinical Pathology established a 2% or lower benchmark for hemolysis rates among laboratory blood samples .
- Hospital Eds have been identified as a major source of hemolyzed samples.

Critical Appraisal
[系統性文獻回顧 Systematic Review]

步驟 1：研究探討的問題為何？

"When drawing blood samples for laboratory testing from patients in the ED, what practices are effective in reducing hemolysis rates among these samples?"

研究族群 / 問題 (Problems)	**Patients receiving treatment in hospital-based EDs.**
介入措施 (Intervention)	Blood collection practices in the ED hypothesized to be associated with hemolysis rates.
比較 (Comparison)	**See Fig 1**

結果 (Outcomes)	**Hemolysis rates**
	• There are two widely used methods of measuring hemolysis in centrifuged blood samples:
	  • Direct spectrophotometric readings by instrument (quantitative and objective)
	  • Visual comparison of blood samples with a color chart by laboratory personnel (semi-quantitative and subjective)

步驟 1：研究探討的問題為何？

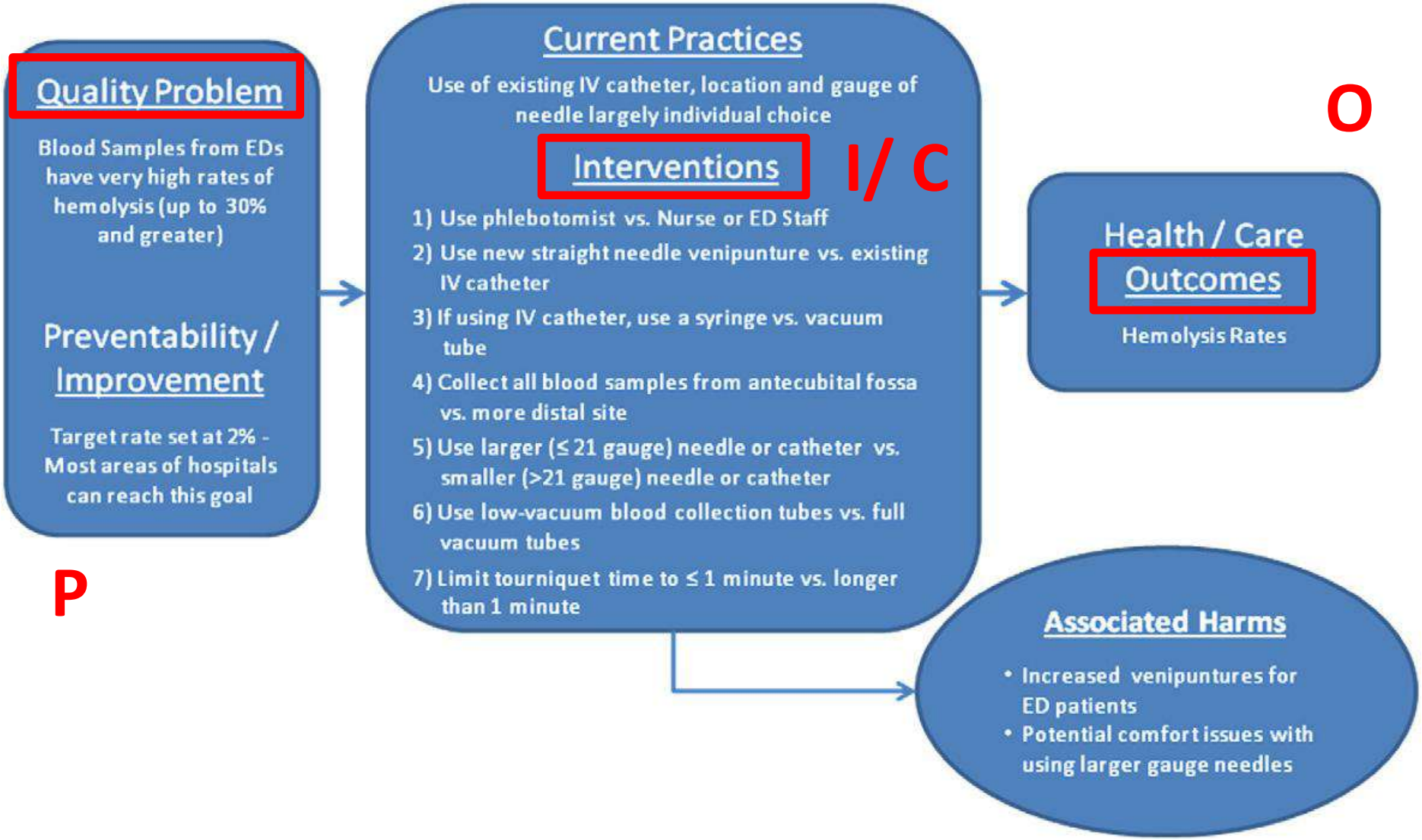


Fig. 1. Analytic framework — when drawing blood samples for laboratory testing from patients in the ED, what practices are effective in reducing hemolysis rates among these samples?

步驟 2：系統性文獻回顧的品質如何？ (FAITH)

Find-良好的文獻搜尋至少應包括二個主要的資料庫，並且加上文獻引用檢索(參考文獻中相 關研究、Web of Science, Scopus 或 Google Scholar)、試驗登錄資料等。文獻搜尋應不只限於英文，並且應同時使用 MeSH 字串及一般檢索詞彙(text words)。

A comprehensive electronic search for literature was conducted with the guidance of a professional librarian from July through October 2011. It included English-language publications (or availability of an English abstract) since 1990.

Search of databases for published, peer reviewed literature as well as gray literature included the NIH maintained PubMed, two professional electronic databases, CINAHL (Cumulative Index to Nursing and Allied Health Literature) and Embase (focusing on international biomedical literature) and VHINL (Virginia Henderson International Nursing Library). The search terms used are included in Appendix C. In addition, hand searches of references in identified publications were also conducted. Finally, a general request for unpublished data that may have been collected by hospital EDs for their own internal surveys was spread through contacts supplied by the LMBP Hemolysis Expert Panel.

評讀結果：□是 □否 □不清楚

Structured search databases and terms

Appendix C. Structured search databases and terms

Date of Search: 8/19/2011
PubMed — NIH Database
Catheters:
((hemolysis [mesh] AND Blood specimen collection [mesh] AND catheters [mesh]) AND "1990"[Publication Date] : "3000"[Publication Date]) AND "0"[Publication Date] : "3000"[Publication Date]
Syringes:
((("hemolysis"[MeSH Terms] AND "blood specimen collection"[MeSH Terms] AND "syringes"[mesh]) AND "1990"[PDAT] : "3000"[PDAT]) AND "0"[PDAT] : "3000"[PDAT]) AND "humans"[MeSH Terms]
Phlebotomy:
(("hemolysis"[MeSH Terms] AND "b
Terms] AND "phlebotomy"[mesh]) ANI
AND "0"[PDAT] : "3000"[PDAT]
Antecubital fossa:
(("hemolysis"[MeSH Terms] OR "blood specimen collection"[MeSH Terms] AND "antecubital fossa" [all text]) AND "1990"[PDAT] : "3000"[PDAT]) AND "0"[PDAT] : "3000"[PDAT]
Needles:
(("hemolysis"[MeSH Terms] AND "blood specimen collection"[MeSH Terms] AND "needles"[mesh]) AND "1990"[PDAT] : "3000"[PDAT]) AND "0"[PDAT] : "3000"[PDAT]
Low vacuum serum collection tubes:
(("hemolysis"[MeSH Terms] OR "blood specimen collection"[MeSH Terms] AND "Point-of-Care Systems"[mesh] AND "INSTRUMENTATION"[SUBHEADING]) AND "1990"[PDAT] : "3000"[PDAT]) AND "0"[PDAT] : "3000"[PDAT] NOT GLUCOSE[TITLE/ABSTRACT] NOT ("diabetes mellitus"[MeSH Terms] OR ("diabetes"[All Fields] AND "mellitus"[All Fields]) OR "diabetes mellitus"[All Fields] OR "diabetes"[All Fields] OR "diabetes insipidus"[MeSH Terms] OR ("diabetes"[All Fields] AND "insipidus"[All Fields]) OR "diabetes insipidus"[All Fields])
Tourniquets:
(("hemolysis"[MeSH Terms] OR "blood specimen collection"[MeSH Terms] AND "tourniquets"[mesh]) AND "1990"[PDAT] : "3000"[PDAT]) AND "0"[PDAT] : "3000"[PDAT]
Duration:
("hemolysis"[MeSH Terms] AND "blood specimen collection"[MeSH Terms] AND "DURATION"[all] AND "1990"[PDAT] : "3000"[PDAT]) AND "0"[PDAT] : "3000"[PDAT]

CINAHL — Cumulative Index to Nursing and Allied Health Literature
search 1
(MM "hemolysis" OR TX "erythrocytolysis" OR TX "erythrolysis") AND (MH "catheters" OR TI "catheters" OR AB "catheters" OR MH "Tourniquet" OR TI "Tourniquet" OR AB "Tourniquet" OR TI "needle" OR AB "needle" OR TI "syringe" OR AB "syringe") AND (MH "emergency medicine" OR TI "ER" OR AB "ER" OR TI "ED" OR AB "ED" OR TI "emergency room" OR AB "Emergency room" OR TI "ED" OR AB "ED" OR MH "Intesive Care Units, Neonatal" OR TI "NICU" OR AB "NICU")
search 2
(MM "hemolysis" OR TX "erythrocytolysis" OR TX "erythrolysis" OR
") AND (MH "phlebot-
MH"catheterization")
R AB "ER" OR TI "ED"
OR AB "ED" OR TI "emergency room" OR AB "Emergency room" OR TI "ED" OR AB "ED" OR MH "Intesive Care Units, Neonatal" OR TI "NICU" OR AB "NICU")

Embase
search 1
erythrocytolysis':ab,ti OR 'erythrolysis':ab,ti OR 'hemolysis':de AND ('blood sampling':de,ab,ti OR 'point of care testing':de,ab,ti) AND ('emergency ward':de OR 'newborn intensive care':de) AND [humans]/lim AND [english]/lim AND [1990–2012]/py
search 2
'erythrocytolysis':ab,ti OR 'erythrolysis':ab,ti OR 'hemolysis':de OR 'sample hemolysis':ab AND 'blood sampling':de,ab,ti AND ('catheter':de,ab,ti OR 'tourniquet':de,ab,ti OR 'needle':de,ab,ti OR 'venipuncture':de,ab,ti OR 'syringe':de,ab,ti) AND ('emergency ward':de OR 'newborn intensive care':de) AND [1990–2012]/py
search 3
'erythrocytolysis':ab,ti OR 'erythrolysis':ab,ti OR 'hemolysis':de OR 'sample hemolysis':ab OR 'blood sampling':de,ab,ti AND ('catheter':de,ab,ti OR 'tourniquet':de,ab,ti OR 'needle':de,ab,ti OR 'venipuncture':de,ab,ti OR 'syringe':de,ab,ti) AND ('emergency ward':de OR 'newborn intensive care':de) NOT 'blood stream infections':de,ab,ti AND [1990–2012]/py
search 4: 12 results
'hemolysis'/mj AND ('catheter':de,ab,ti OR 'tourniquet':de,ab,ti OR 'needle':de,ab,ti OR 'venipuncture':de,ab,ti OR 'syringe':de,ab,ti) AND ('emergency ward':de OR 'er':ab,ti OR 'ed':ab,ti OR 'newborn intensive care':de OR 'nicu':ab,ti) AND [humans]/lim AND [english]/lim AND [1990–2012]/py

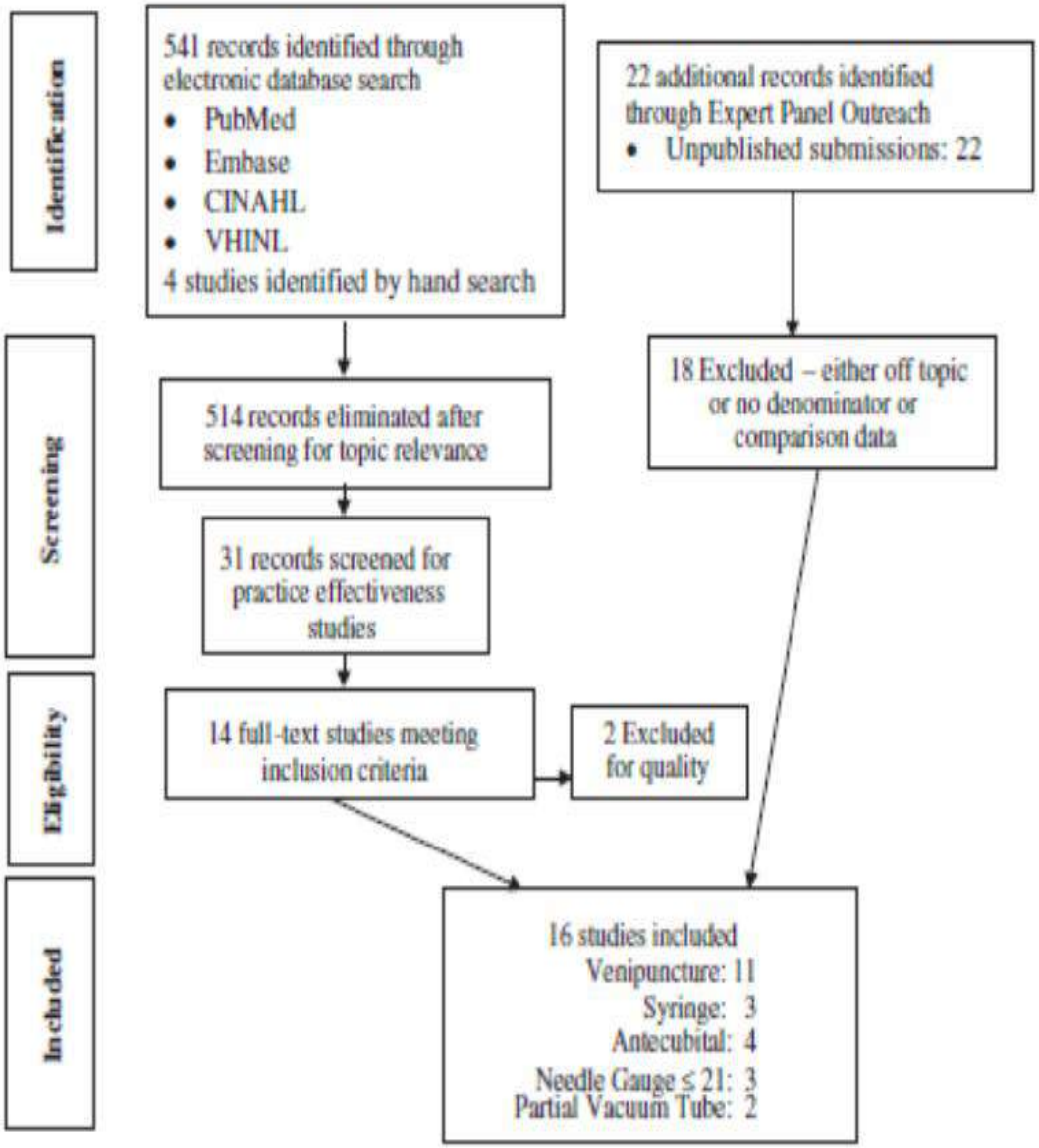


Fig. 2. Systematic review flow diagram. Flow diagram showing appraisal of published studies found in electronic databases and unpublished studies identified through outreach, resulting in the final 16 studies fully reviewed in this analysis.

A - 文獻是否經過嚴格評讀 (Appraisal)？

應根據不同臨床問題的文章類型，選擇適合的評讀工具，並說明每篇研究的品質
(如針對治療型的臨床問題，選用隨機分配、盲法、及完整追蹤的研究類型)

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Methods

This evidence review followed the CDC-sponsored Laboratory Medicine Best Practices Initiative's (LMBP) "A-6 Cycle" systematic review methods for evaluating quality improvement practices [21]. This approach is derived from previously validated methods, and is designed to produce transparent systematic review of practice effectiveness to support evidence-based best practice recommendations.

A review team conducts the systematic review and includes a review coordinator and staff trained to apply the LMBP methods. The team is guided by a multi-disciplinary expert panel[1] including at least one LMBP Workgroup[2] member and individuals selected for their diverse perspectives and relevant expertise in the topic area, laboratory management, and evidence review methods.

評讀結果：□是 □否 □不清楚

A - 文獻是否經過嚴格評讀 (Appraisal) ?

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Table 1
Straight needle venipuncture vs. IV starts.

Study	Study quality rating	Effect size rating
Agos et al. (2008)	Fair	Substantial
Grant (2003)	Fair	Substantial
Kennedy et al. (1996)	Fair	Substantial
Ong et al. (2008)	Fair	Substantial
Staszewski et al. (2011)	Fair	Substantial
Dameron Hosp (unpub)	Good	Substantial
Giavarina et al. (2010)	Good	Substantial
Lowe et al. (2008)	Good	Substantial
Mary Washington Hosp (unpub)	Good	Substantial
Raisky et al. (1994)	Good	Substantial
U of Minnesota Hosp (unpub)	Good	Substantial

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Table 2
Antecubital site vs. more distal site (IV starts only).

Study	Study quality rating	Effect size rating
Dugan et al. (2005)	Fair	Substantial
Dameron Hosp (unpub)	Good	Substantial
Lowe et al. (2010)	Good	Substantial
Munnix et al. (2010)	Good	Substantial

A - 文獻是否經過嚴格評讀 (Appraisal)？

Appendix E. Evidence summary tables for reducing hemolysis in the ED

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Bibliographic information Overall rating	Study* Category (points deducted)	Practice* Category (points deducted)	Outcome measures* Category (pts deducted)	Results/findings* Category (points deducted)
– **Author(s)**: Agos, MD; Lizarraga, R; Gambra, D; Maranon, A; Orozco, C; Diaz, E. – **Year**: 2008 – **Publication**: Anales del sistema sanitario de Navarra – **Affiliations**: Hospital Virgen del Camino Pamplona, Spain – **Funding**: Internal	– **Design**: (0) Cross-sectional Observational – **Facility/setting**: (0) Accident & Emergency Dept. in a tertiary hospital serving >200,000 – **Time period**: (0) 34 days (Sept–Nov 2006) — three uneven time periods assigned to 3 types of IV catheters – **Population/sample**: (0) 1933 Adult (≥15) ED patients A) 3 catheter groups: 1) 'Protectiv' (Teflon) N = 475 (10 days) 2) 'Protectiv plus' (polyurethane) N = 426 (9 days) 3) 'BD-Nexiva' (Vialone) N = 684 (15 days) B) Straight needle venipunctures — N = 384 (entire 34 day period) — **Comparator**: (0) 1) Straight needle vs. IV start — **Study bias**: (1) No systematic bias noted, but did not provide data to control potential confounding by training, site of venipuncture, use of syringe or vacuum tubes	-**Description**: (0) Practices evaluated: 1) IV draws — 3 specific IV catheters (18 or 20 gauge) 2) Straight needle venipuncture (21 gauge) – **Duration**: (0) 34 days over 3 months – **Training**: (0) Minimal – **Staff/other resources**: (0) Minimal — not described – **Cost**: (0) Not provided	– **Description**: (0) Hemolysis as determined by laboratory staff — no other description – **Recording method**: (1) Not described	– **Type of findings**: (0) Rates of hemolysis – **Findings/effect size**: (0) 1) *Straight needle vs. IV start* 7/348 (2%) vs. 222/1585 (14%) *Other findings*: IV catheter size: Gauge 18: 115/867 (13%) Gauge 20: 107/708 (15%) IV catheter type: Teflon: 39/475 (8%) +18 Gauge: 19/301 (6.3%) +20 Gauge: 20/164 (12.2%) Polyurethane: 77/426 (18%) +18 Gauge: 51/243 (21.0%) +20 Gauge: 26/183 (14.2%) Vialone: 106/684 (15%) +18 Gauge: 45/323 (13.9%) +20 Gauge: 61/361 (16.9%) – **Statistical significance/test(s)**: (0) Authors calculate ORs and 95% CI – **Results/conclusion biases**: (1) Usefulness of results is restricted by lack of information on staff drawing blood, site, and syringe vs. vacuum tube
Quality rating: 7 (fair) **Effect rating: Substantial** **Relevance: Direct**	**Study (3 max): 2** As noted, lack of control for potential confounders	**Practice (2 max): 2**	**Outcome (2 max): 1** As noted, lack of information process	**Results/findings (3 max): 2** As noted, suffered from lack of sufficient information

7分:fair
8~10分: good

*Numbers in () by category headings reflect the number of points deducted from the maximum points for that column domain.

I - 是否只納入 (included) 具良好效度的文章？

僅進行文獻判讀是不足夠，系統性文獻回顧只納入至少要有一項研究結果是極小偏誤的試驗。

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- **All abstracted results that received a "good" or "fair" study quality rating had their results converted to risk ratios, which were plotted on common graph for each practice reviewed.**
- A grand mean estimate of the result of the practice was calculated using inverse variance weights andmixed-effects models,3 a valuable tool for estimating precision and assessing the consistency and patterns of results across studies .
- The key criteria for including studies in the meta-analyses were sufficient data to calculate an effect size and use of an outcome that is judged similar enough to the other studies being summarized.
- The grand mean estimate and its confidence interval were considered more accurate representations of the results of a practice than that obtained from individual studies . By convention, all meta analysis results are presented in tabular forest plots and are generated using Comprehensive Meta-analysis software (v. 2.2.064, Statistical Solutions).
- For this review, an expert review panel determined that a "substantial" effect is a reduction of hemolysis by 50%, as represented by a risk ratio of 0.5 or less.

評讀結果：□是 □否 □不清楚

T - 作者是否以表格和圖表「總結」(total up) 試驗結果？

應該用至少 1 個摘要表格呈現所納入的試驗結果。若結果相近，可針對結果進行統合分析(meta-analysis)，並以「森林圖」(forest plot)呈現研究結果，最好再加上異質性分析

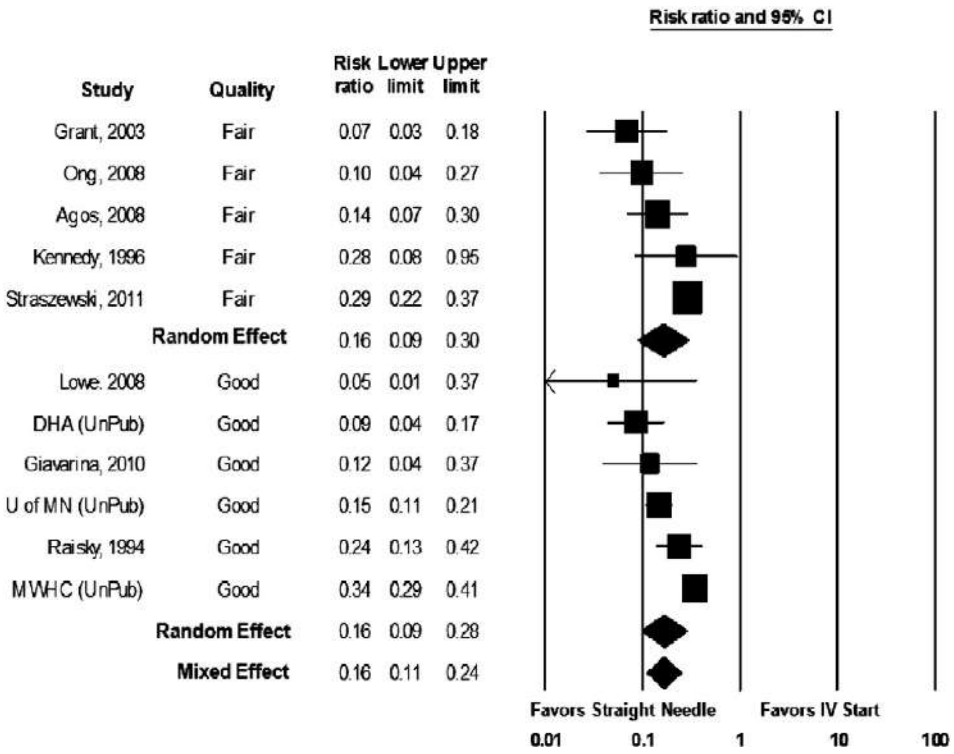

Fig. 3. Meta-analysis results for straight needle venipuncture vs. IV starts. Mixed effects analysis using forest plot representations

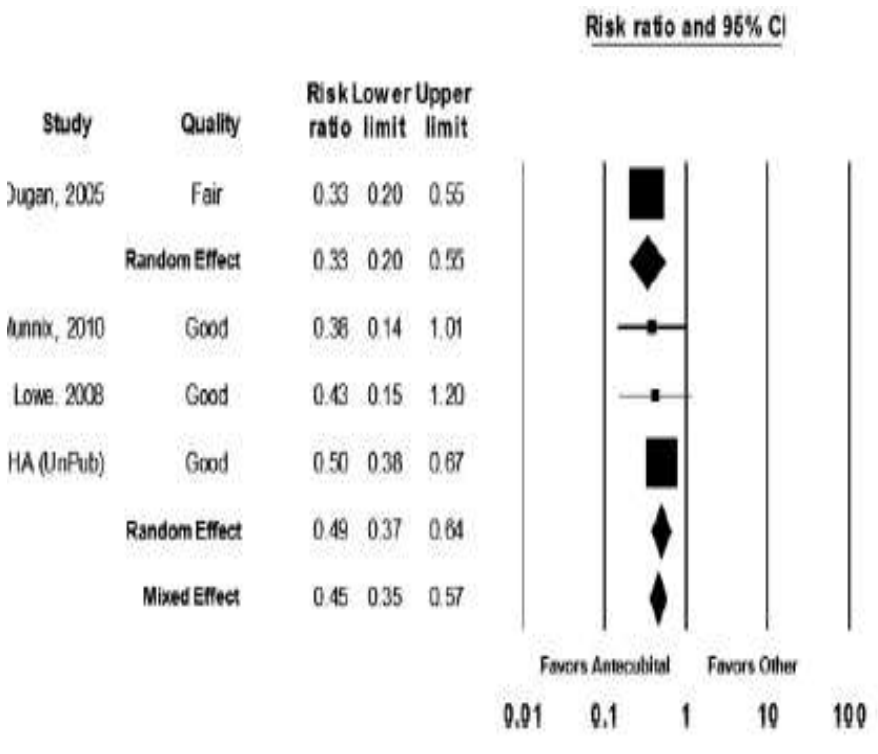

Fig. 4. Results for antecubital site vs. more distal site (IV starts only). Mixed effects analysis using forest plot representations

評讀結果：□是 □否 □不清楚

T - 作者是否以表格和圖表「總結」(total up) 試驗結果？

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Appendix E. Evidence summary tables for reducing hemolysis in the ED

Note: Scoring information see: Christenson et al. (2011)
(In the tables — numbers in parentheses show points deducted)

Bibliographic information Overall rating	Study* Category (points deducted)	Practice* Category (points deducted)	Outcome measures* Category (pts deducted)	Results/findings* Category (points deducted)
– **Author(s)**: Agos, MD; Lizarraga, R; Gambra, D; Maranon, A; Orozco, C; Diaz, E. – **Year**: 2008 – **Publication**: Anales del sistema sanitario de Navarra – **Affiliations**: Hospital Virgen del Camino Pamplona, Spain – **Funding**: Internal	– **Design**: (0) Cross-sectional Observational – **Facility/setting**: (0) Accident & Emergency Dept. in a tertiary hospital serving >200,000 – **Time period**: (0) 34 days (Sept–Nov 2006) — three uneven time periods assigned to 3 types of IV catheters – **Population/sample**: (0) 1933 Adult (≥15) ED patients A) 3 catheter groups: 1) "Protectiv" (Teflon) N=475 (10 days) 2) "Protectiv plus" (polyurethane) N=426 (9 days) 3) "BD-Nexiva" (Vialone) N=684 (15 days) B) Straight needle venipunctures — N=384 (entire 34 day period) — **Comparator**: (0) 1) Straight needle vs. IV start — **Study bias**: (1) No systematic bias noted, but did not provide data to control potential confounding by training, site of venipuncture, use of syringe or vacuum tubes	-**Description**: (0) Practices evaluated: 1) IV draws — 3 specific IV catheters (18 or 20 gauge) 2) Straight needle venipuncture (21 gauge) – **Duration**: (0) 34 days over 3 months – **Training**: (0) Minimal – **Staff/other resources**: (0) Minimal — not described – **Cost**: (0) Not provided	– **Description**: (0) Hemolysis as determined by laboratory staff — no other description – **Recording method**: (1) Not described	– **Type of findings**: (0) Rates of hemolysis – **Findings/effect size**: (0) 1) *Straight needle vs. IV start* 7/348 (2%) vs. 222/1585 (14%) *Other findings:* IV catheter size: Gauge 18: 115/867 (13%) Gauge 20: 107/708 (15%) IV catheter type: Teflon: 39/475 (8%) +18 Gauge: 19/301 (6.3%) +20 Gauge: 20/164 (12.2%) Polyurethane: 77/426 (18%) +18 Gauge: 51/243 (21.0%) +20 Gauge: 26/183 (14.2%) Vialone: 106/684 (15%) +18 Gauge: 45/323 (13.9%) +20 Gauge: 61/361 (16.9%) – **Statistical significance/test(s)**: (0) Authors calculate ORs and 95% CI – **Results/conclusion biases**: (1) Usefulness of results is restricted by lack of information on staff drawing blood, site, and syringe vs. vacuum tube
Quality rating: 7 (fair) **Effect rating: Substantial** **Relevance: Direct**	**Study (3 max): 2** As noted, lack of control for potential confounders	**Practice (2 max): 2**	**Outcome (2 max): 1** As noted, lack of information process	**Results/findings (3 max): 2** As noted, suffered from lack of sufficient information

*Numbers in ( ) by category headings reflect the number of points deducted from the maximum points for that column domain.

評讀結果：□是 □否 □不清楚

H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？

在理想情況下，各個試驗的結果應相近或具同質性，若具有異質性，作者應評估差異是否顯著(卡方檢定)。根據每篇個別研究中不同的PICO及研究方法，探討造成異質性的原因。

Evidence of antecubital site vs. distal sites practice effectiveness

Only studies using IV starts were available for this practice comparison. Four studies of blood draws using IV catheters provided evidence on the effectiveness of drawing blood from the antecubital site rather than a more distal site. One of the studies was judged to be of "fair" quality while the remaining studies were rated "good" (Table 2). All four studies were judged by the expert panel to show consistent, "substantial" reductions in hemolysis through the use of antecubital rather than distal sites. Based on these four studies, the overall expected reduction in hemolysis of 55% (RR = 0.45, 95% CI = 0.35–0.57) and the results are homogeneous ($Q_{overall} = 2.20$, $p = 0.533$, $I^2 = 0.00$) (Fig. 4). Applying the LMBP criteria, the overall strength of evidence for use of the antecubital site for reduction of hemolysis rates is "high".

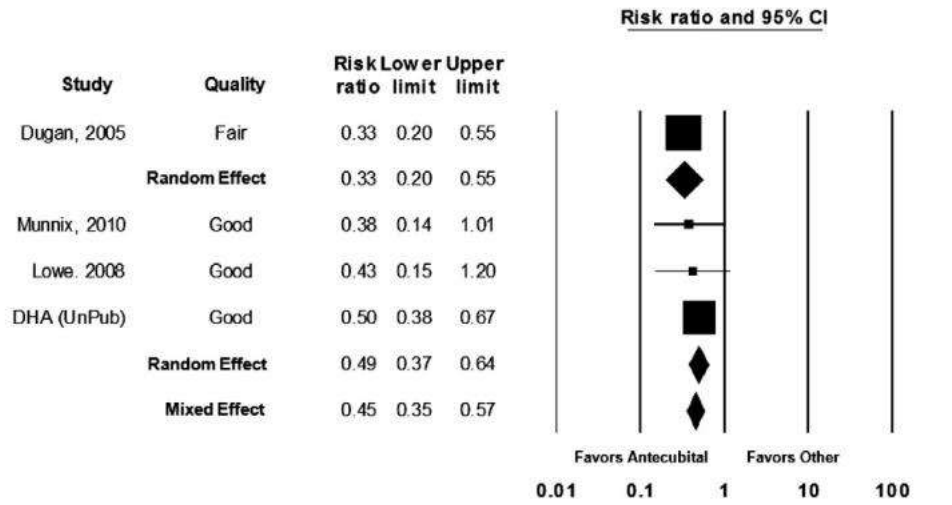


Fig. 4. Results for antecubital site vs. more distal site (IV starts only). Mixed effects analysis using forest plot representations.

評讀結果：■ 是 □ 否 □不清楚

H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？

在理想情況下，各個試驗的結果應相近或具同質性，若具有異質性，作者應評估差異是否顯著(卡方檢定)。根據每篇個別研究中不同的PICO及研究方法，探討造成異質性的原因。

Evidence of use of ≤21-gauge (larger) needles practice effectiveness

Most studies of straight needle venipunctu
ited range of needle sizes for analyses (usually
therefore only studies using IV starts were ava
comparison. Three studies provided evidence
reducing hemolysis in IV starts. Two studies
ratings because they did not control for need
studies reported "substantial" reductions in
≤21 gauge (larger) needles while the single
"good" reported a "minimal/none" reduction i
location of venipuncture was controlled (Table 4). Although the meta-analysis mean risk ratio for ≤21 gauge (larger) needles is substantial (RR = 0.37, 95% CI = 0.27–0.52) and equal to approximately a 63% reduction in hemolysis, the individual study effect size results for needle size are "inconsistent" and heterogeneous ($Q_{Overall}$ = 14.82, p = 0.001, I^2 = 86.50) (Fig. 6).

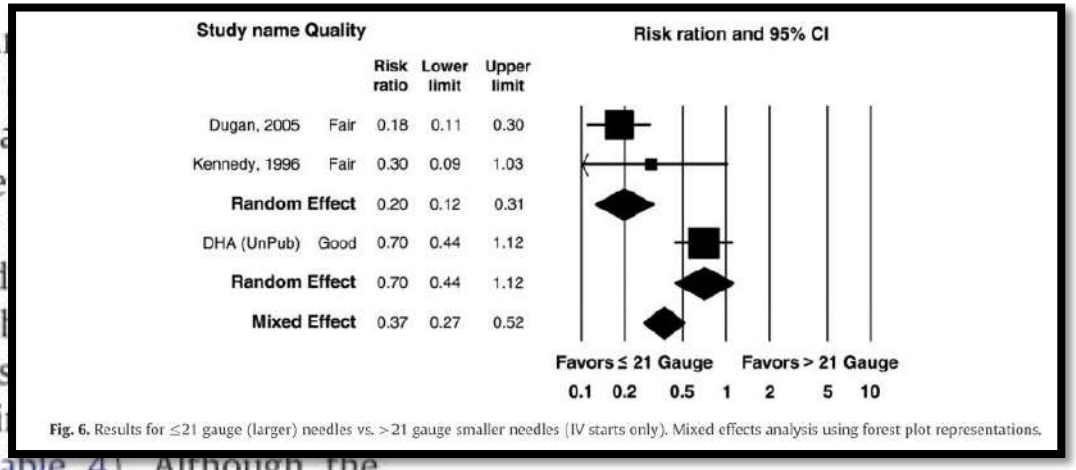
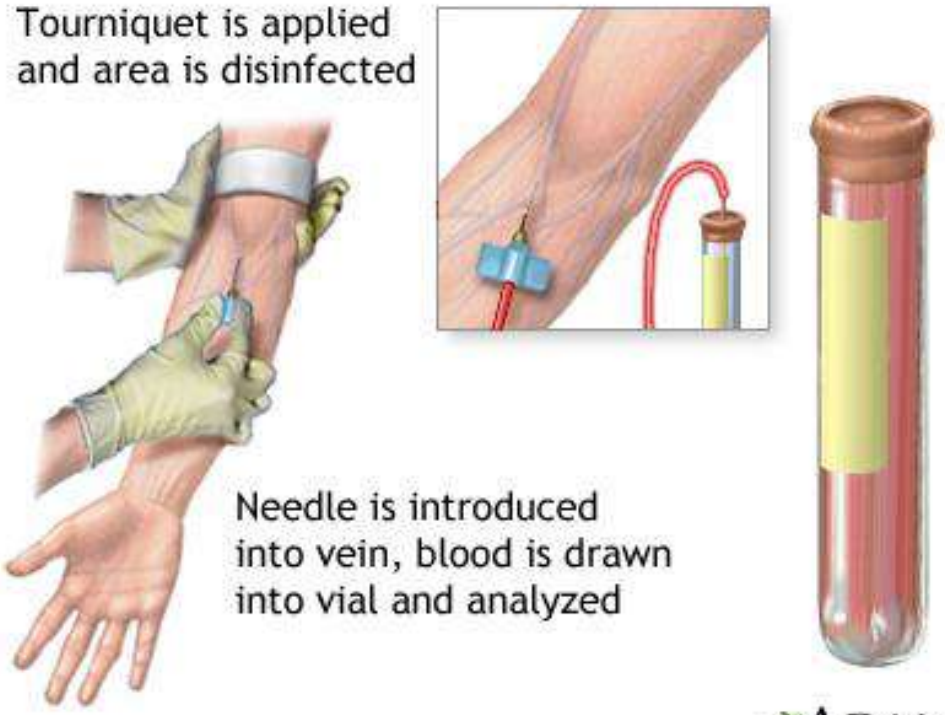


Fig. 6. Results for ≤21 gauge (larger) needles vs. >21 gauge smaller needles (IV starts only). Mixed effects analysis using forest plot representations.

評讀結果：■是 □否 □不清楚

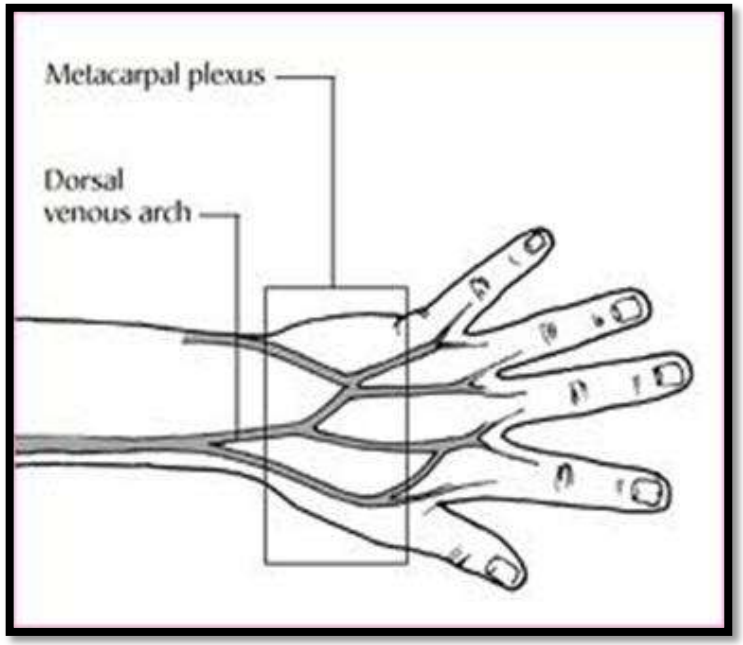
Conclusion

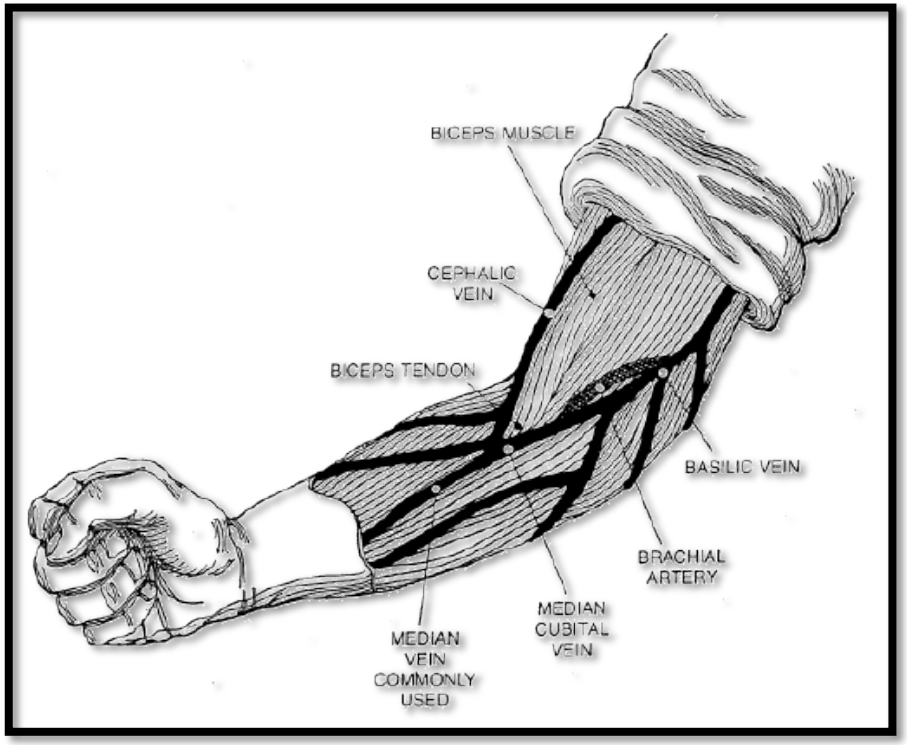
- **可減少檢體溶血的措施-1**
  - 直接靜脈抽血較靜脈留置抽血能減少溶血



Conclusion

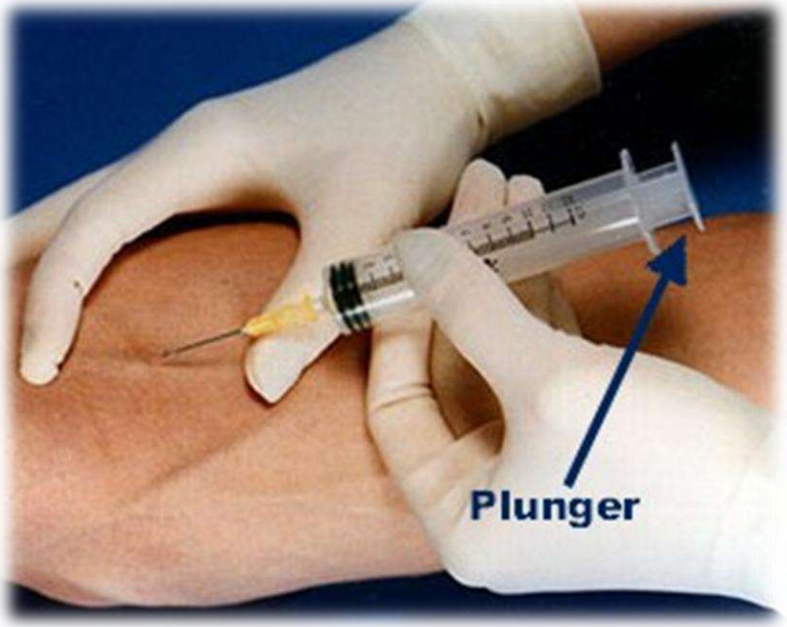
- **可減少檢體溶血的措施-2**
  - –肘前端採血較遠端採血能減少溶血





Conclusion

- **可減少檢體溶血的措施-3**
  - 打上留置針時使用空針抽血、比使用真空管能減少溶血



Conclusion

- **可減少檢體溶血的措施-4**
  - 使用部分真空試管較使用全真空試管能有效降低溶血率
  - Low (partial) vacuum tube vs. standard (full) vacuum tubes.

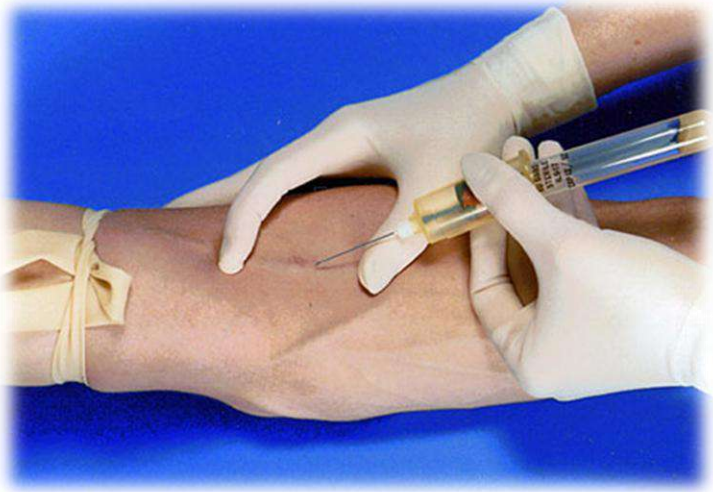
Conclusion

- **對於減少檢體溶血沒有幫助的措施**
  - 跟由急診護理人員採檢相比，專門抽血者不一定能降低溶血
  - 沒有研究顯示綑綁止血帶與溶血有關

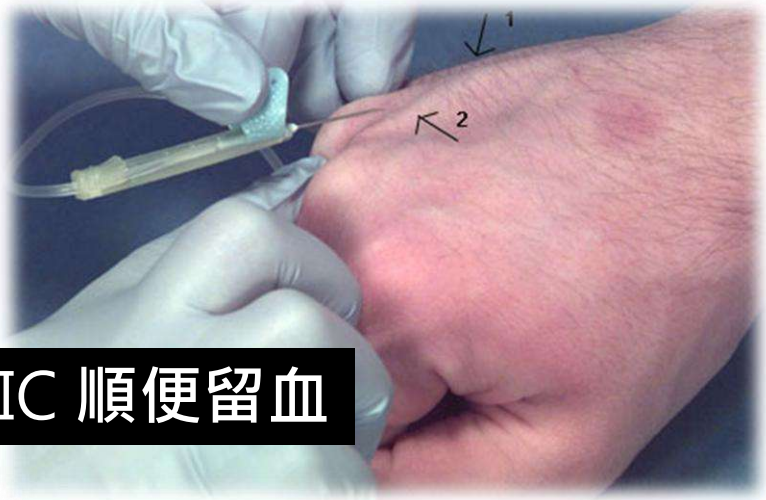
- **研究文獻不足**
  - 針頭大小與溶血的關係

Discussion Point

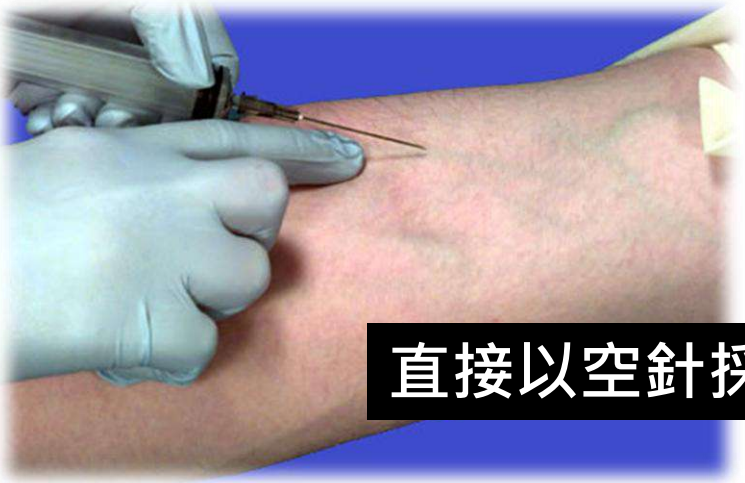
- 用何種方式抽血，比較不容易造成簡體溶血?



空針+真空管採血



On IC 順便留血



直接以空針採血

http://www.healthcare.uiowa.edu/cme/clia/modules.asp?testID=13#Image01

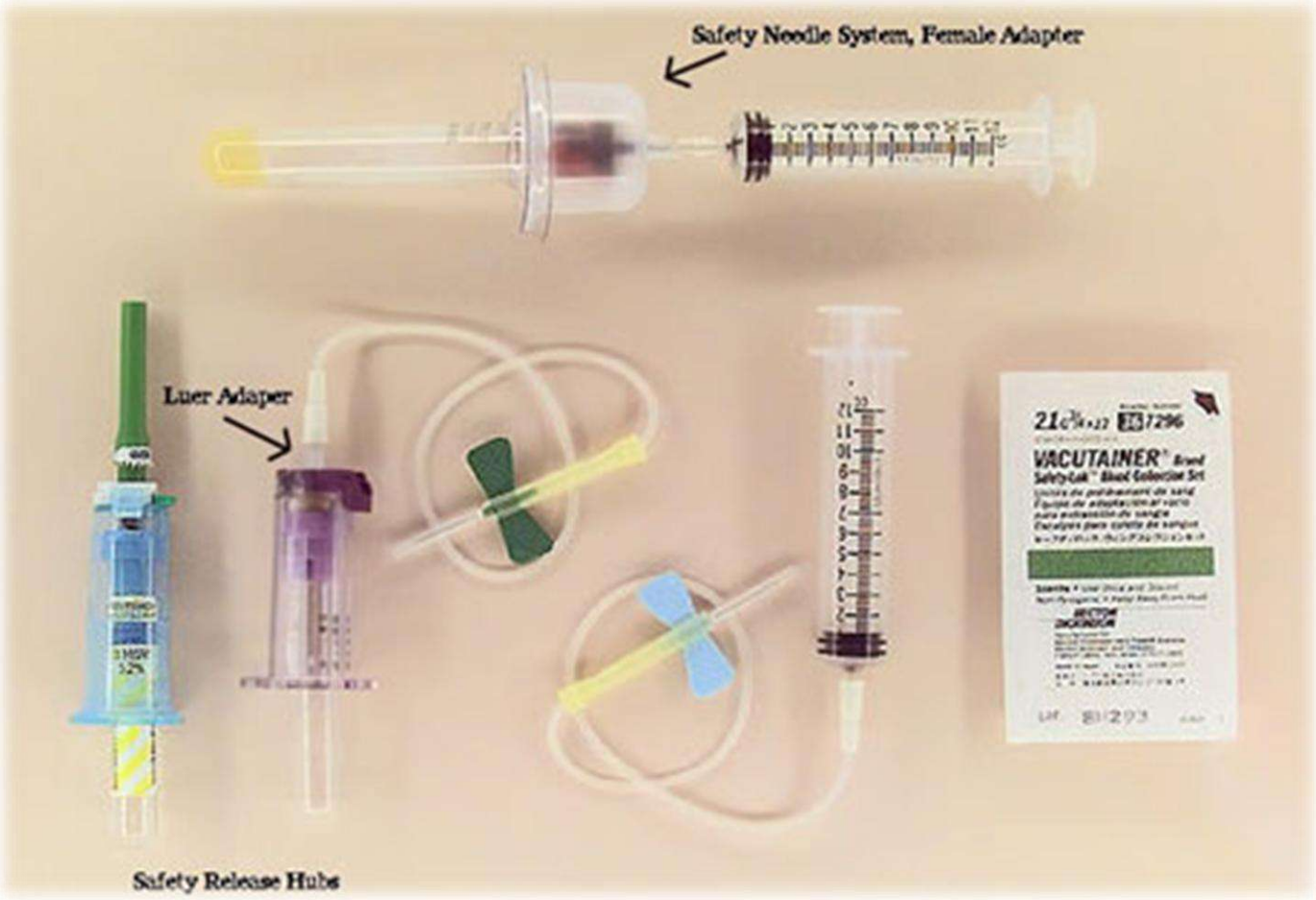
Discussion Point-1

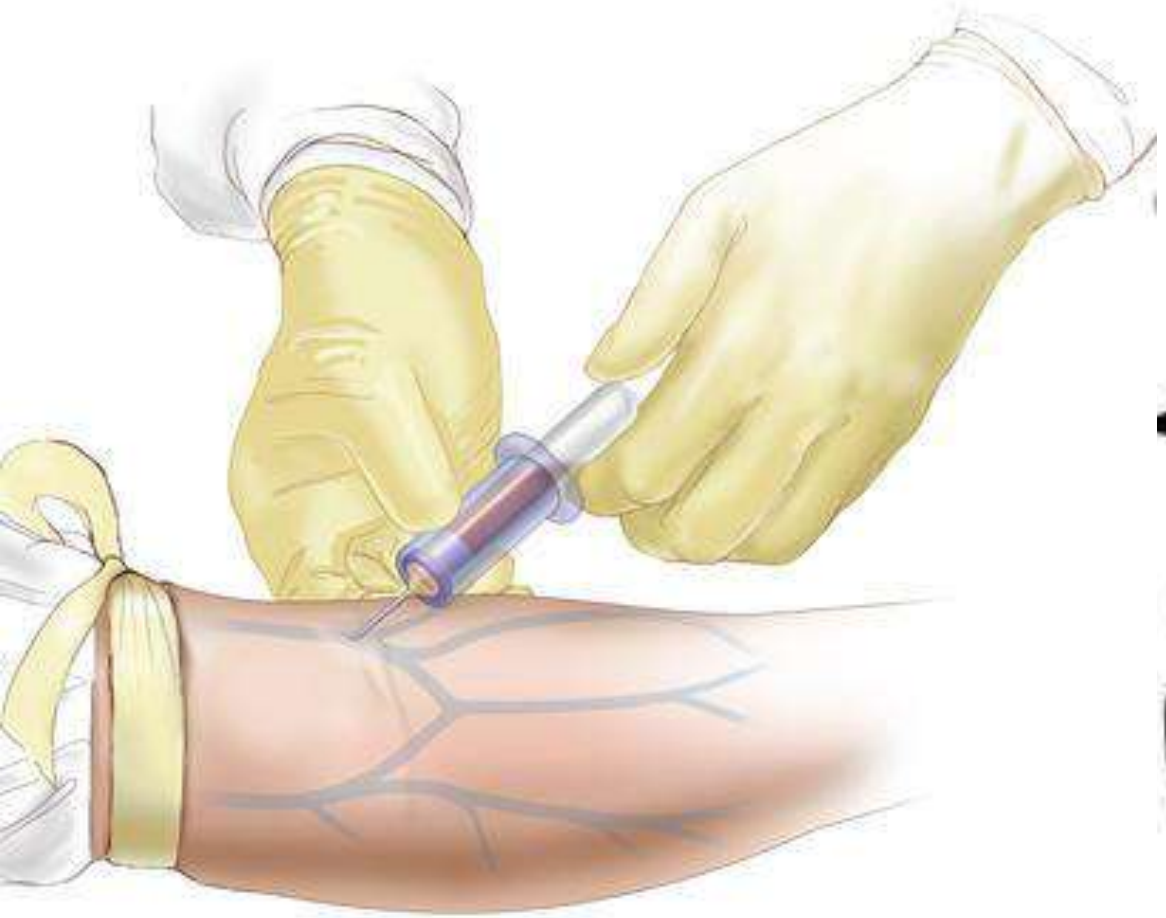
急診是否考量另外採血 (不在on IC 時順便留檢體)?

- 同意2人
- 懷疑7人
- 不同意10人

Discussion Point-2

- 尋覓更好的設備，減少檢體溶血






謝射