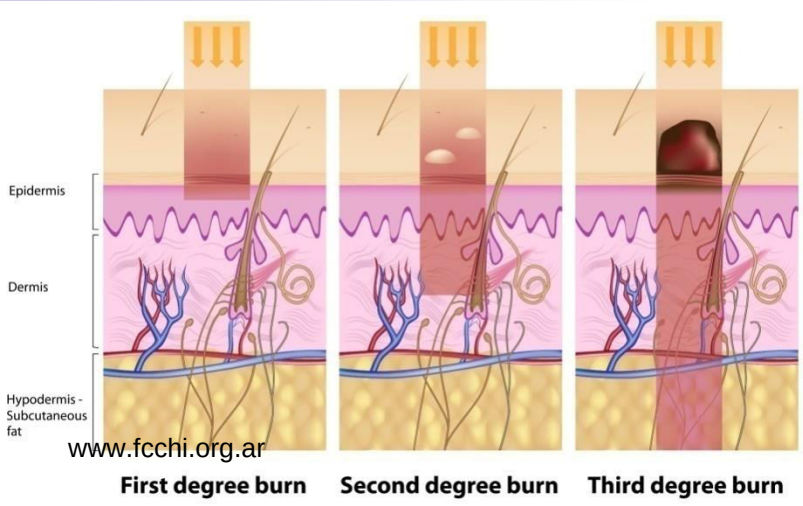
INFECCIONES EN PACIENTES QUEMADOS

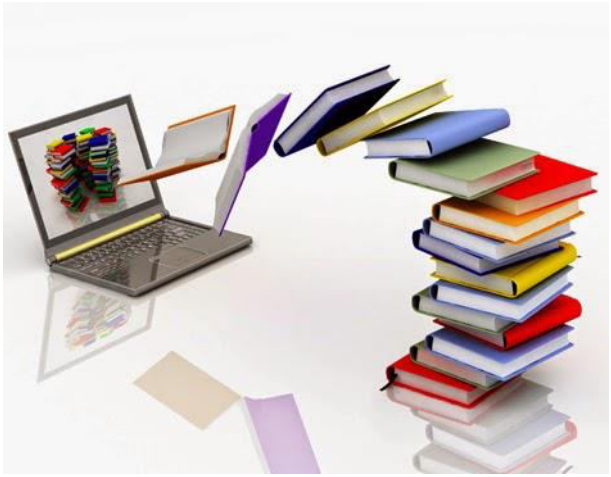


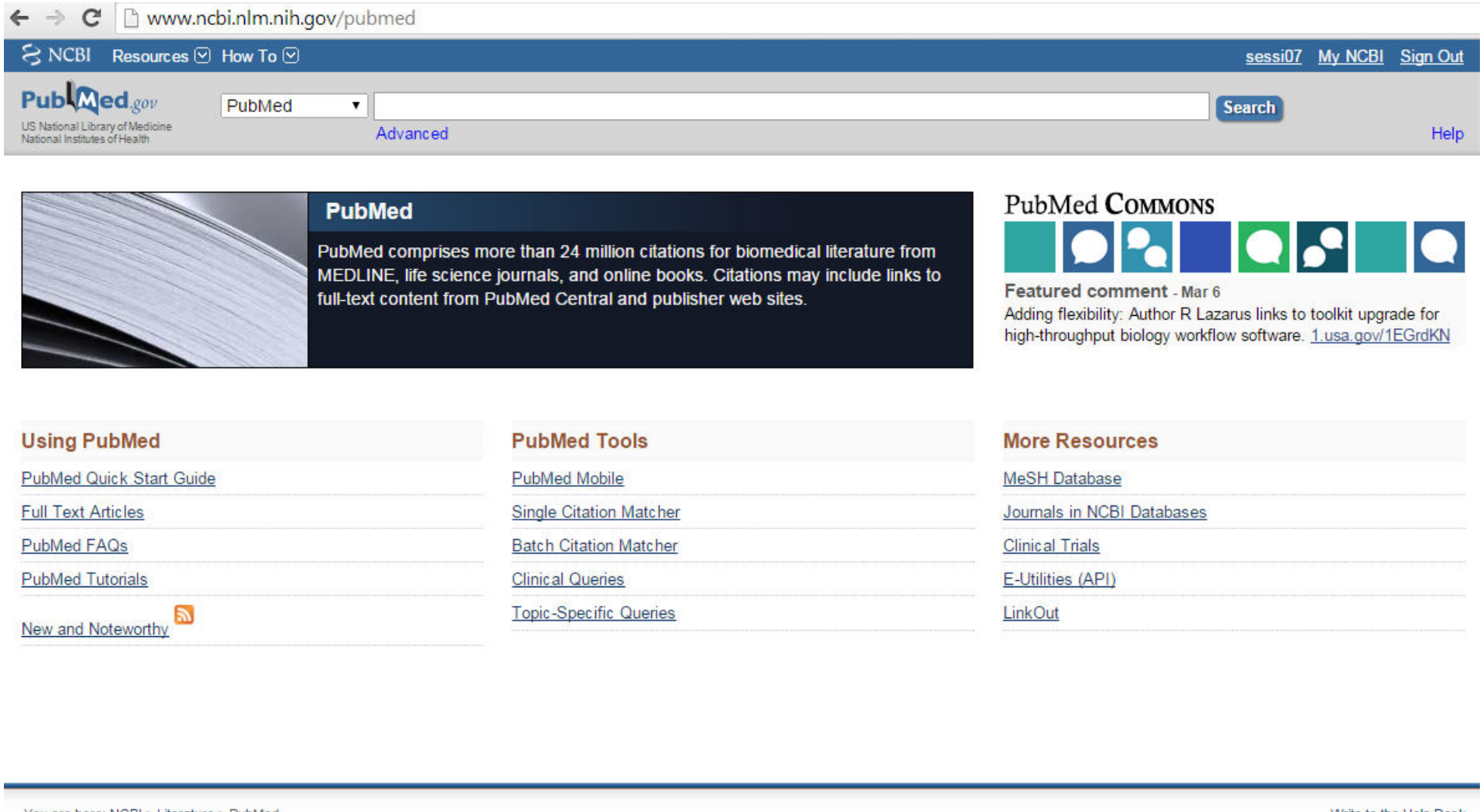
Jesica Asparch
Julieta Hagel
Residentes de Terapia Intensiva

HOSPITAL ITALIANO

- La sepsis y la falla multiorgánica son las principales causas de muerte en los pacientes quemados
- Los criterios clásicos para diagnosticar infección y sepsis no son aplicables en pacientes quemados debido a la respuesta inflamatoria que presentan
- Retrasos en el tratamiento de las infecciones se asocian con peor pronóstico

BÚSQUEDA BIBLIOGRÁFICA

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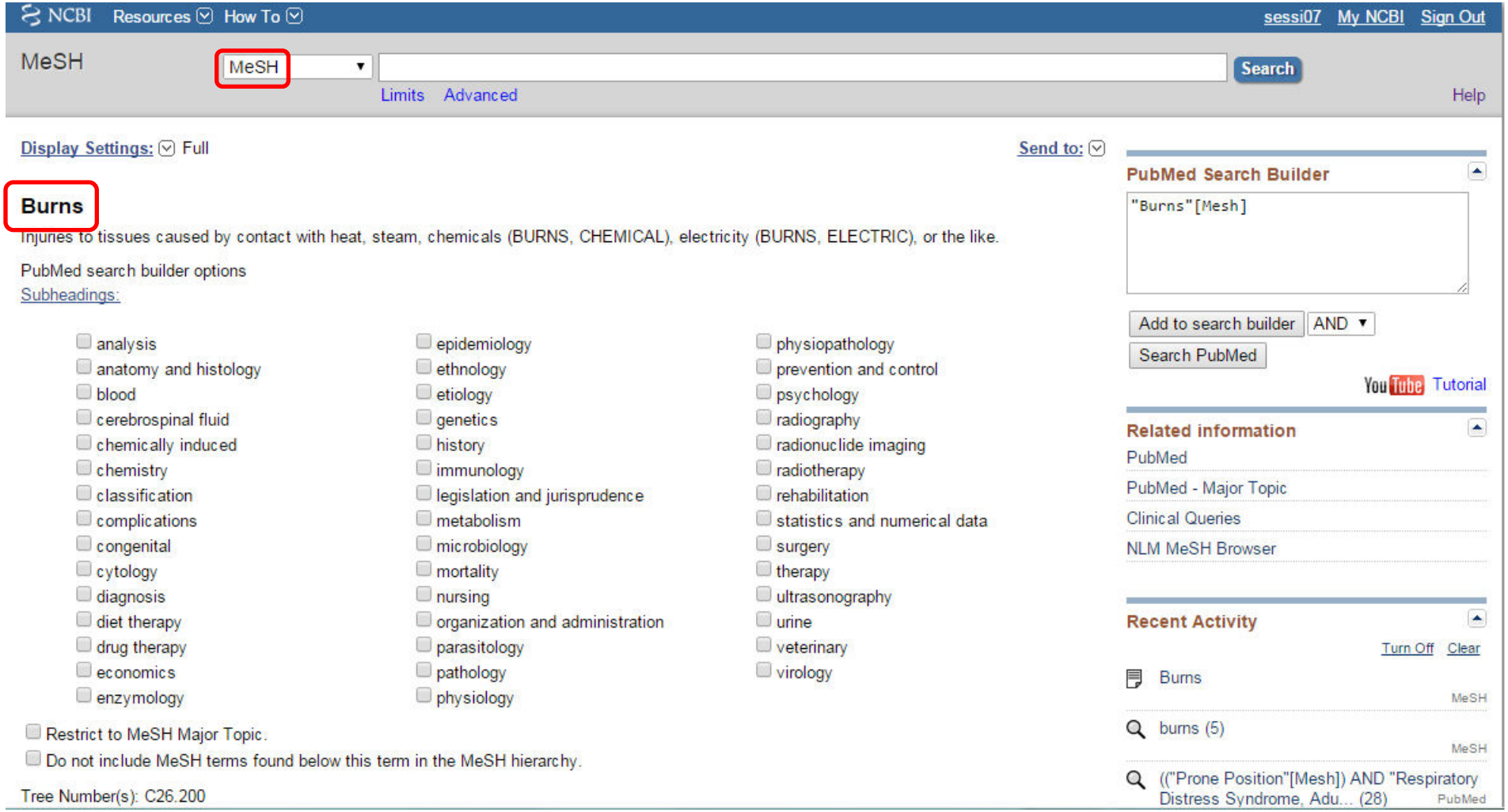
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Injuries to tissues caused by contact with heat, steam, chemicals (BURNS, CHEMICAL), electricity (BURNS, ELECTRIC), or the like.
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Subheadings:
analysis
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cerebrospinal fluid
chemically induced
chemistry
classification
complications
congenital
cytology
diagnosis
diet therapy
drug therapy
economics
enzymology
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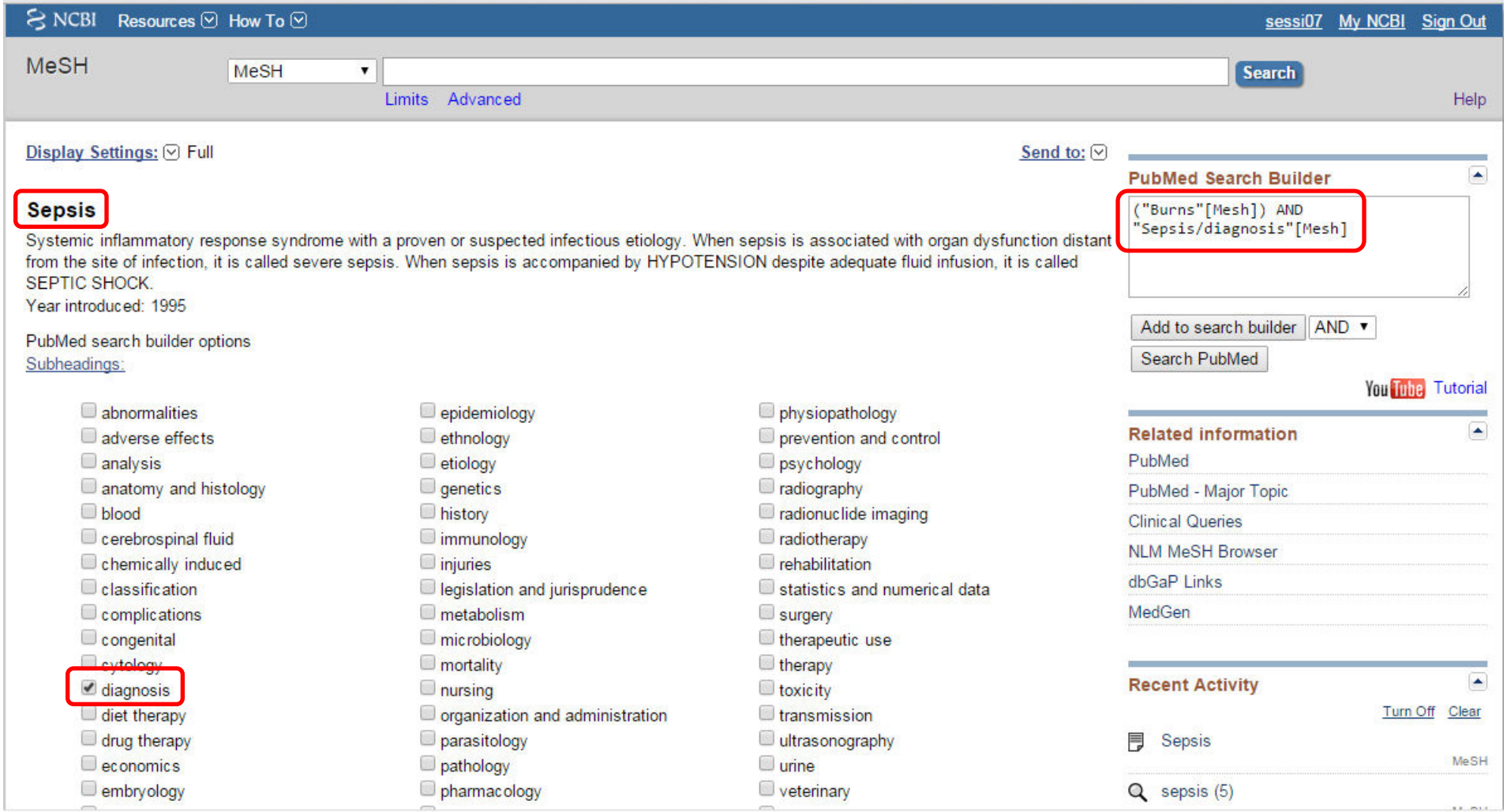
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Sepsis
Systemic inflammatory response syndrome with a proven or suspected infectious etiology. When sepsis is associated with organ dysfunction distant from the site of infection, it is called severe sepsis. When sepsis is accompanied by HYPOTENSION despite adequate fluid infusion, it is called SEPTIC SHOCK.
Year introduced: 1995
PubMed search builder options
Subheadings:
abnormalities
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cerebrospinal fluid
chemically induced
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diagnosis
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Zhang Q, Liao Z.
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Antimicrob Agents Chemother. 2014;58(2):1039-46. doi: 10.1128/AAC.01632-13. Epub 2013 Nov 25.

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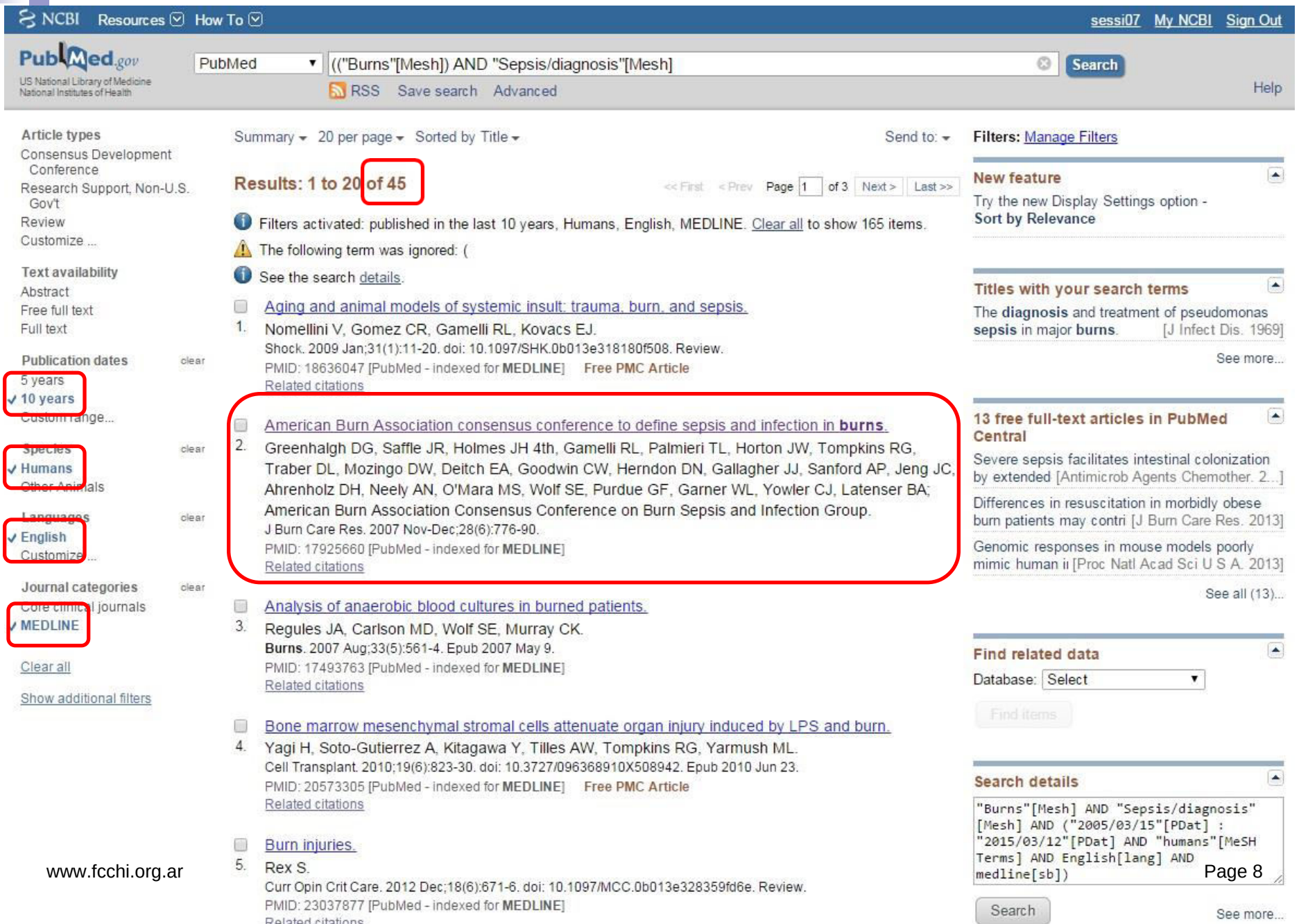

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1. Aging and animal models of systemic insult: trauma, burn, and sepsis.
Nomellini V, Gomez CR, Gamelli RL, Kovacs EJ.
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Rex S.
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PMID: 23037877 [PubMed - indexed for MEDLINE]
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J Burn Care Res. 2007 Nov-Dec;28(6):776-90.

American Burn Association consensus conference to define sepsis and infection in burns.

Greenhalgh DG[1], Saffle JR, Holmes JH 4th, Gamelli RL, Palmieri TL, Horton JW, Tompkins RG, Traber DL, Mozingo DW, Deitch EA, Goodwin CW, Herndon DN, Gallagher JJ, Sanford AP, Jeng JC, Ahrenholz DH, Neely AN, O'Mara MS, Wolf SE, Purdue GF, Garner WL, Yowler CJ, Latenser BA; American Burn Association Consensus Conference on Burn Sepsis and Infection Group.

Author information

Abstract

Because of their extensive wounds, burn patients are chronically exposed to inflammatory mediators. Thus, burn patients, by definition, already have "systemic inflammatory response syndrome." Current definitions for sepsis and infection have many criteria (fever, tachycardia, tachypnea, leukocytosis) that are routinely found in patients with extensive burns, making these current definitions less applicable to the burn population. Experts in burn care and research, all members of the American Burn Association, were asked to review the literature and prepare a potential definition on one topic related to sepsis or infection in burn patients. On January 20, 2007, the participants met in Tucson, Arizona to develop consensus for these definitions. After review of the definitions, a summary of the proceedings was prepared. The goal of the consensus conference was to develop and publish standardized definitions for sepsis and infection-related diagnoses in the burn population. Standardized definitions will improve the capability of performing more meaningful multicenter trials among burn centers.

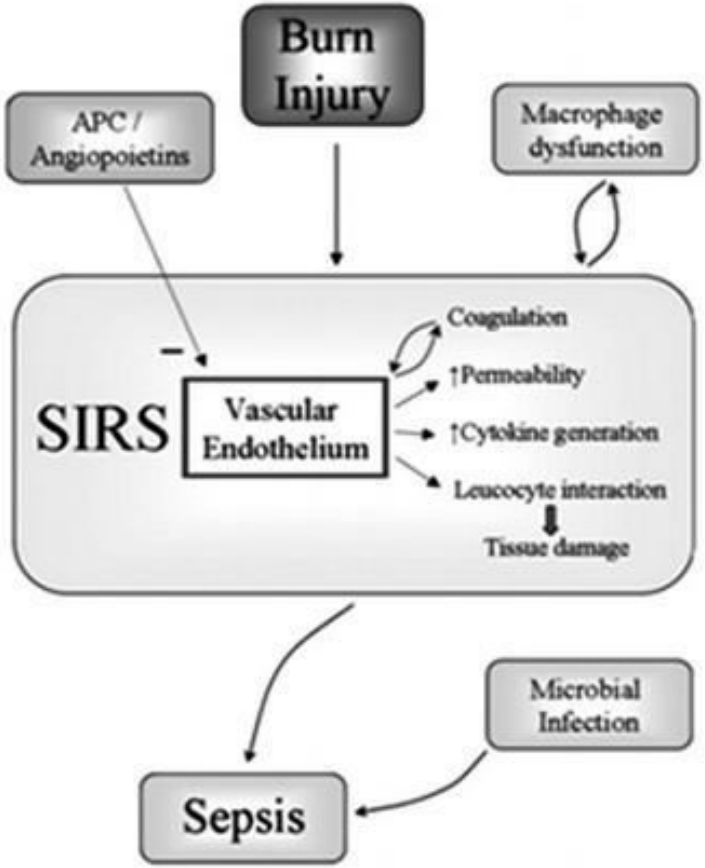
PMID: 17925660 [PubMed - indexed for MEDLINE]

SPECIAL REPORT

American Burn Association Consensus Conference to Define Sepsis and Infection in Burns

The American Burn Association Consensus Conference on Burn Sepsis and Infection Group; David G. Greenhalgh, MD,* Jeffrey R. Saffle, MD,† James H. Holmes, IV, MD,‡ Richard L. Gamelli, MD,§ Tina L. Palmieri, MD,* Jureta W. Horton, PhD,¶ Ronald G. Tompkins, MD,‖ Daniel L. Traber, PhD,** David W. Mozingo, MD,†† Edwin A. Deitch, MD,‡‡ Cleon W. Goodwin, MD,§§ David N. Herndon, MD,** James J. Gallagher, MD,** Art P. Sanford, MD,** James C. Jeng, MD,¶¶ David H. Ahrenholz, MD,‖‖ Alice N. Neely, PhD,*** Michael S. O'Mara, MD,* Steven E. Wolf, MD,††† Gary F. Purdue, MD,¶ Warren L. Garner, MD,‡‡‡ Charles J. Yowler, MD,§§§ Barbara A. Latenser, MD¶¶¶

Because of their extensive wounds, burn patients are chronically exposed to inflammatory mediators. Thus, burn patients, by definition, already have "systemic inflammatory response syndrome." Current definitions for sepsis and infection have many criteria (fever, tachycardia, tachypnea, leukocytosis) that are routinely found in patients with extensive burns, making these current definitions less applicable to the burn population. Experts in burn care and research, all members of the American Burn Association, were asked to review the literature and prepare a potential definition on one topic related to sepsis or infection in burn patients. On January 20, 2007, the participants met in Tucson, Arizona to develop consensus for these definitions. After review of the definitions, a summary of the proceedings was prepared. The goal of the consensus conference was to develop and publish standardized definitions for sepsis and infection-related diagnoses in the burn population. Standardized definitions will improve the capability of performing more meaningful multicenter trials among burn centers. (J Burn Care Res 2007;28:776–790)



Annals of Plastic Surgery • Volume 65, Number 2, August 2010

CRITERIOS DIAGNÓSTICOS DE INFECCIÓN

Sepsis should be considered when three or more of the following criteria are met:

1. Temperature: > 39°C or < 36.5°C
2. Progressive tachycardia: > 110 beats/min
3. Progressive tachypnea:
   a. > 25 breaths/min not ventilated
   b. Minute ventilation > 12 L/min ventilated
4. Thrombocytopenia (not applied until 3 d after initial resuscitation): < 100,000/µL
5. Hyperglycemia (in the absence of preexisting diabetes mellitus)
   a. Untreated plasma glucose > 200 mg/dL or equivalent mM/L
   b. > 7 U of insulin/hr IV drip
   c. Significant resistance to insulin (> 25% increase in insulin requirement over 24 hr)
6. Inability to continue enteral feedings > 24 hr
   a. Abdominal distension
   b. High gastric residuals (residuals two times feeding rate)
   c. Uncontrollable diarrhea (> 2,500 mL/d)

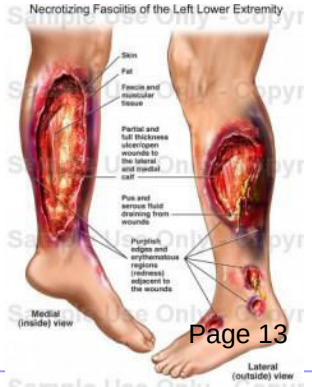
Al menos 3

1. Positive culture
2. Pathologic tissue source
3. Clinical response to antimicrobials

Al menos 1

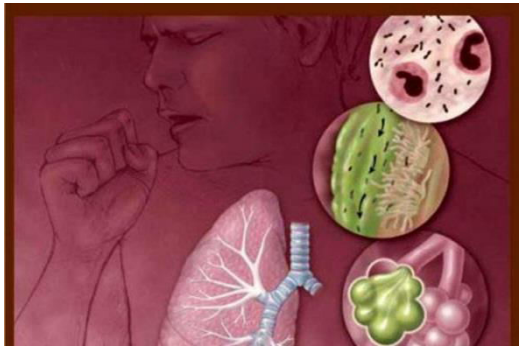
INFECCIONES DE LA HERIDA

- **COLONIZACIÓN**
  - Baja concentración de bacterias en la herida (<10^5 bact/gr de tejido)
- **INFECCIÓN**
  - Alta concentración de bacterias en la herida (>10^5 bact/gr de tejido)
  - Sin signos de infección sistémica
- **INFECCIÓN INVASIVA**
  - Alta concentración de bacterias en la herida (>10^5 bact/gr de tejido)
  - Signos de infección sistémica
- **CELULITIS**
  - Bacterias presentes en la herida
  - Eritema, induración y edema del tejido circundante
- **FASCITIS NECROTIZANTE**
  - Infección invasiva con necrosis tisular

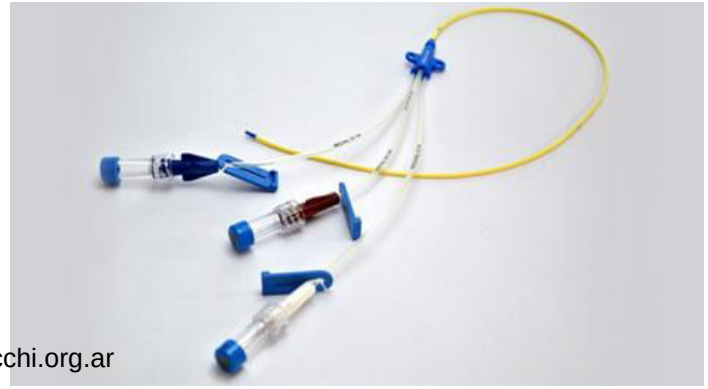


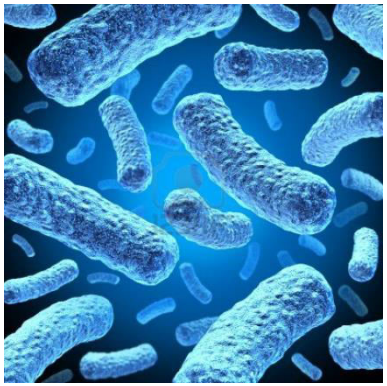
INFECCIONES NO RELACIONADAS A LA HERIDA

- **NEUMONÍA**
  - Diagnóstico clínico (2 criterios o más)
    - Rx tórax que muestra un infiltrado nuevo y persistente, consolidaqción o cavitación.
    - Sepsis
    - Un cambio reciente en el esputo o esputo purulento
  - Microbiología positiva
    - Aspirado traqueal: $>10^5$ organismos
    - BAL: $> 10^4$ organismos
    - Cepillado bronquial: $> 10^3$ organismos
  - Clasificación
    - **CONFIRMADA**: clínica + patógeno asilado
    - **PROBABLE:** clínica sin confirmación microbiológica
    - **POSIBLE**: anormalidades radiológicas con moderada a baja sospecha clínica, pero con rescate de gérmen



- **INFECCIÓN ASOCIADA A CATETER**
- **BACTERIEMIA**
- **UROSEPSIS**





- No existen recomendaciones específicas acerca de la toma de muestras para hemocultivos en este tipo de pacientes.

La profilaxis con antibióticos **NO** está recomendada

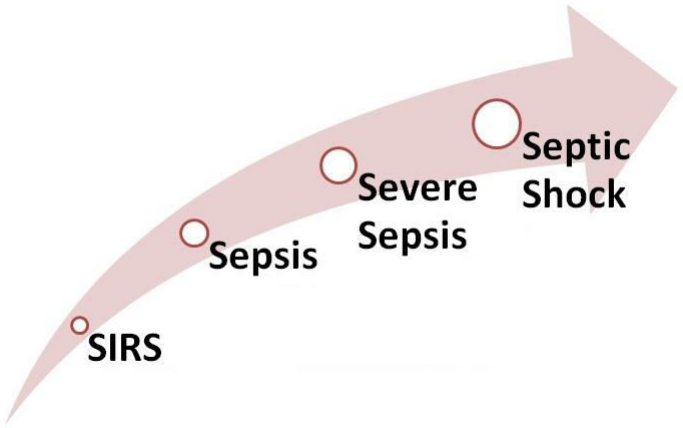
TRATAMIENTO

- Agentes tópicos
- Escisión del tejido
- Antiobioticoterapia sistémica

CONSIDERACIONES ESPECIALES

- Los parámetros farmacocinéticos se ven alaterados en el paciente quemado, con grandes variaciones intra e interindividuales.
  - 1er fase (1ras 48): disminuye la eliminación renal de drogas
  - 2da fase (>48 hs): se altera la unión a proteinas, la distribución de drogas y el clearence, resultando en menores concentraciones plasmáticas, pudiendo ser necesario dosis mayores o intervalos de administración mas frecuentes.
- Se recomienda dosaje del fármacos en plasma

MARCADORES DE SEPSIS EN QUEMADOS



PROCALCITONINA

- Es un péptido precursor de la hormona calcitonina

- Aumenta ante estímulos proinflamatorios, sobre todo de origen bacteriano.

BURNS 37 (2011) 549–558

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Review

Use of procalcitonin for the detection of sepsis in the critically ill burn patient: A systematic review of the literature☆

Elizabeth A. Mann [a,c,*], *Geri L. Wood* [a,b], *Charles E. Wade* [c]

[a] *University of Texas Health Sciences Center, Houston, TX - School of Nursing, United States*
[b] *MD Anderson Cancer Center, Houston, TX, United States*
[c] *US Army Institute of Surgical Research, San Antonio, TX, United States*

ARTICLE INFO

Article history:
Accepted 22 April 2010

Keywords:
Procalcitonin
Sepsis
Intensive care
Burn
Diagnosis

ABSTRACT

The purpose of this systematic review was to assess the evidence for use of routine procalcitonin testing to diagnose the presence of sepsis in the burn patient. The electronic databases MEDLINE, Cochrane, CINAHL, ProQuest, and SCOPUS were searched for relevant studies using the MeSH terms burn, infection, procalcitonin, and meta-analysis. The focus of the review was the adult burn population, but other relevant studies of critically ill patients were included as data specific to the patient with burns are limited. Studies were compiled in tabular form and critically appraised for quality and level of evidence. Four meta-analyses, one review of the literature, one randomized controlled trial, nine prospective observational, and three retrospective studies were retrieved. Six of these studies were specific to the burn population, with one specific to burned children. Only one meta-analysis, one adult burn and one pediatric burn study reported no benefit of procalcitonin testing to improve diagnosis of sepsis or differentiate sepsis from non-infectious systemic inflammatory response. The collective findings of the included studies demonstrated benefit of incorporating procalcitonin assay into clinical sepsis determination. Evaluation of the burn specific studies is limited by the use of guidelines to define sepsis and inconsistent results from the burn studies. Utility of the procalcitonin assay is limited due to the lack of availability of rapid, inexpensive tests. However, it appears procalcitonin assay is a safe and beneficial addition to the clinical diagnosis of sepsis in the burn intensive care unit.

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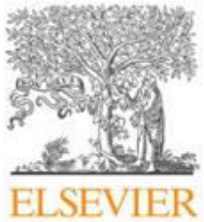
BURNS 38 (2012) 356–363



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PCT as a diagnostic and prognostic tool in burn patients. Whether time course has a role in monitoring sepsis treatment

A. Lavrentieva [a,*], S. Papadopoulou [b], J. Kioumis [c], E. Kaimakamis [c], M. Bitzani [a]

[a] Papanikolaou General Hospital, Burn ICU, Thessaloniki, Greece
[b] Papanikolaou General Hospital, Burn Surgery Department, Thessaloniki, Greece
[c] Papanikolaou General Hospital, Pulmonary Department, Thessaloniki, Greece

ARTICLE INFO

Article history:
Accepted 29 August 2011

Keywords:
Sepsis
Localized infection
Procalcitonin
Diagnostic accuracy

ABSTRACT

Objective: To evaluate the diagnostic and prognostic performance of inflammatory markers for septic and non septic (localized) bacterial infections in patients with severe burn.
Methods and results: Data of 145 patients were prospectively included in this study. Serum procalcitonin and other inflammatory markers were measured within 24 h after burn and daily thereafter. Maximum procalcitonin ($p = 0.004$) was independent predictors of outcome in logistic regression analysis. PCT thresholds of 1.5 ng/ml, 0.52 ng/ml and 0.56 ng/ml had adequate sensitivity and specificity to diagnose sepsis, respiratory tract and wound infections respectively. A threshold value of 7.8 ng/ml in PCT concentration on day 3 was associated with the effectiveness of the sepsis treatment with an AUC of 0.86 (95% CI 0.69–1.03, $p = 0.002$). C-reactive protein levels and WBCs showed no significant change over the first 3 days in the patients with successfully treated sepsis ($p = 0.93$).
Conclusion: The maximum procalcitonin level has prognostic value in burn patients. PCT can be used as a diagnostic tool in patients with infectious complications with or without bacteremia during ICU stay. Daily consecutive PCT measurements may be a valuable tool in monitoring the effectiveness of antibiotic therapy in burn ICU patients.

Table 1 – Inflammatory markers and SOFA score in sepsis, respiratory tract infection (with and without sepsis), burn wound infection (with and without sepsis) and urinary tract infection.

	PCT, median (IQR), ng/ml	CRP, median (IQR), mg/dl	WBC, median (IQR), ($10^9 \times l^{-1}$)	Temp, median (IQR), (°C)	SOFA, median (IQR)
Sepsis (all septic patients, *n*:86)	7.2 (0.4–33)	17.65 (2–39)	14.6(2–33)	37.9 (33–41)	7 (2–15)
Pre infection	0.44 (0.1–1.8)	12.0 (4.5–30.7)	12.7 (4.6–13.7)	37.7(36–39)	3 (1–9)
p^*	<0.001	<0.001	0.004	0.198	<0.001
Sepsis (unknown etiology, *n*:11)	8.9 (0.6–21)	19.5 (15–26)	15.4 (3.3–24)	38.5 (35–39)	7.9 (4–14)
Pre infection	0.48 (0.2–1.2)	10.5 (6–26.8)	10.3 (5–16.5)	38.1 (35.5–39)	2.7 (2–7)
p^*	<0.001	<0.001	<0.01	0.07	<0.001
Blood stream infection (*n*:28)	10.4 (4.1–25)	24.3 (11.8–38)	18 (8.4–23)	38.6 (38–40)	6.7 (5–8)
Pre infection	0.46 (0.2–1.8)	9.3 (7–12.8)	15.6 (8.9–13.5)	37.7 (35–39)	3 (2–6)
p^*	<0.001	<0.001	0.07	0.06	0.01
Respir. tract infection (with sepsis, *n*:33)	6.3 (1.6–19)	23.6 (17.7–27)	12.2 (5.8–13)	37 (33–38.5)	6 (5–9)
Pre infection	0.25 (0.1–0.4)	13.7 (11.5–15.4)	7.9 (5.8–11.4)	36.2 (35–37.8)	4 (3–7)
p^*	<0.001	<0.001	<0.01	0.07	0.055
Respir. tract infection (without sepsis, *n*:24)	0.73 (0.1–4)	17.0 (10.5–38)	10.9 (24–26.7)	38.1(34–40)	5 (2–9)
Pre infection	0.38 (0.1–3.6)	16.150 (10.5–28.7)	9.9(4.8–18.5)	37.1(35.5–39)	3 (1–9)
p^*	0.011	0.743	0.48	0.013	<0.001
Wound infection (with sepsis, *n*:14)	4.5 (0.8–8)	13.5 (3.8–15.7)	20.5 (11–24)	37.6 (35–39)	6.3 (5–9)
Pre infection	0.4 (0.1–0.8)	10.8 (9–11)	10 (4.5–13)	38.6 (38 = 39)	2.6 (2–3)
p^*	<0.001	0.06	0.01	0.07	0.01
Wound infection (without sepsis, *n*:20)	0.87 (0.2–5.4)	18.5(1.9–38.50	13,400 (5000–31,000)	38.3 (35–40)	3 (1–8)
Pre infection	0.35 (0.1–3.4)	11.0 (6.5–28)	10,640 (3800–22,300)	37.3(36–40)	3 (1–7)
p^*	<0.001	0.12	0.05	0.329	0.177
Urinary tract infection (without sepsis, *n*:9)	0.36 (0.1–0.4)	14.2 (7.7–14.5)	11,360 (7700–23,500)	38.6 (37–38.9)	2.5 (1–4)
Pre infection	0.2 (0.1–0.34)	12.9 (7.3–21.2)	10,500 (8380–13,500)	38.3 (37–39)	2.4 (2–4)
p^*	0.545	0.237	0.411	0.359	0.9

PCT, procalcitonin; CRP, C-reactive protein; WBC, white blood cell count; Temp, temperature; SOFA, Sequential Organ Failure Assessment score.

* Difference between pre infection and infection levels.

- Aumento significativo de la procalcitonina en pacientes sépticos con respecto a niveles presépticos
- Antibioticoterapia efectiva disminuye rapidamente los valores de procalcitonina
- La superioridad de la PCT sobre la PCR se ve en las infecciones localizadas

Pro BNP y SRVI

A New Marker of Sepsis Post Burn Injury?*

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Objectives: Accurate diagnosis of sepsis is difficult in patients post burn due to the large inflammatory response produced by the major insult. We aimed to estimate the values of serum N-terminal pro-B-type natriuretic peptide and procalcitonin and the changes in hemodynamic variables as markers of sepsis in critically ill burn patients.
Design: Prospective, observational study.
Setting: A quaternary-level university-affiliated ICU.
Patients: Fifty-four patients with burns to total body surface area of greater than or equal to 15%, intubated with no previous cardiovascular comorbidities, were enrolled.
Interventions: At admission, a FloTrac/Vigileo system was attached and daily blood samples taken from the arterial catheter. Infection surveillance was carried out daily with patients classified as septic/nonseptic according to American Burns Consensus criteria.
Measurements and Main Results: N-terminal pro-B-type natriuretic peptide, procalcitonin, and waveform analysis of changes in stroke volume index and systemic vascular resistance index were measured within the first 24 hours after burn and daily thereafter for the length of the ICU stay or until their first episode of sepsis. Prevalences of stroke volume variation less than 12% (normovolemia) with hypotension (systolic blood pressure < 90 mm Hg) were recorded. Patients with sepsis differed significantly from "no sepsis" for N-terminal pro-B-type natriuretic peptide, systemic vascular resistance index, and stroke volume index on days 3–7. Procalcitonin did not differ between sepsis and "no sepsis" except for day 3. Area under the receiver operating characteristic curves showed excellent discriminative power for B-type natriuretic peptide ($p = 0.001$; 95% CI, 0.99–1.00), systemic vascular resistance index ($p < 0.001$; 95% CI, 0.97–0.99), and stroke volume index ($p < 0.01$; 95% CI, 0.96–0.99) in predicting sepsis but not for procalcitonin (not significant; 95% CI, 0.29–0.46). A chi-square crosstab found that there was no relationship between hypotension with normovolemia (stroke volume variation < 12%) and sepsis.
Conclusions: Serum N-terminal pro-B-type natriuretic peptide levels and certain hemodynamic changes can be used as an early indicator of sepsis in patients with burn injury. Procalcitonin did not assist in the early diagnosis of sepsis. (*Crit Care Med* 2014; 42:2029–2036)
Key Words: burns; natriuretic peptide, brain; procalcitonin; sepsis syndrome; systemic inflammatory response syndrome

*See also p. 2137.

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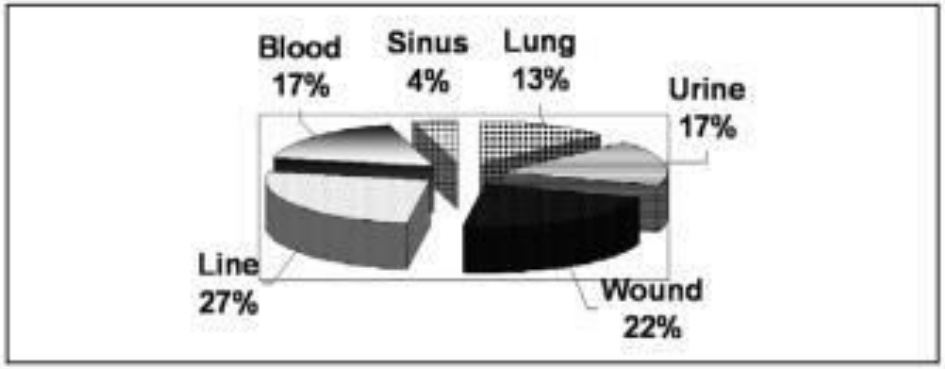

Figure 2. Source of infection for the septic episode.

TABLE 4. Most Commonly Isolated Bacterial Pathogens

Bacteria	No. of Pathogens Isolated From Positive Blood Cultures or Tissue Culture
Gram negative	21
Pseudomonas aeruginosa	8
Klebsiella species	6
Acinetobacter baumannii	2
Serratia marcescens	1
Escherichia coli	2
Gram positive	3
Enterococcus species	1
Staphylococcus aureus	2

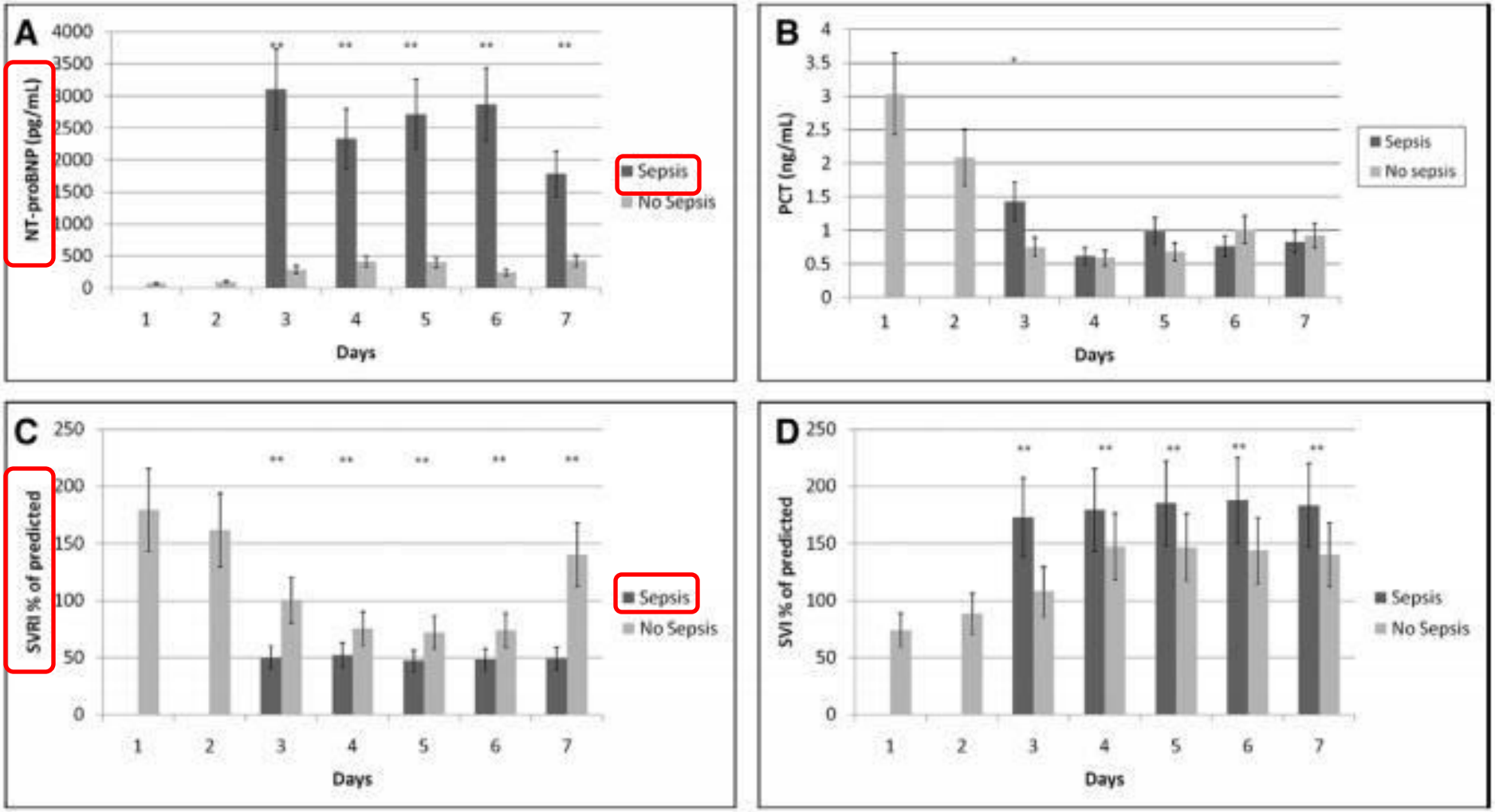

Figure 3. N-terminal pro-B-type natriuretic peptide (NT-proBNP) % of predicted for days 1–7 (**A**), procalcitonin (PCT) over days 1–7 (**B**), systemic vascular resistance index (SVRI) % of predicted for days 1–7 (**C**), and stroke volume index (SVI) % of predicted for days 1–7 (**D**). Number of patients with sepsis (S) and those not reaching the criteria for sepsis (NS) differed each day, apart from days 1 and 2 on which no subjects had sepsis. Number of patients was as follows: day 1 (NS) $n = 54$, day 2 (NS) $n = 54$, day 3 (S) $n = 4$ and (NS) $n = 50$, day 4 (S) $n = 11$ and (NS) $n = 43$, day 5 (S) $n = 16$ and (NS) $n = 37$, day 6 (S) $n = 12$ and (NS) $n = 31$, and day 7 (S) $n = 5$ and (NS) $n = 28$. * indicates that on that particular day patients reaching sepsis criteria were significantly different from those not reaching sepsis criteria: $^{*}p < 0.05$, $^{**}p < 0.01$.

PRESEPSINA

- La presepsina es una proteína que es un fragmento terminal de los CD14
- Se origina durante el proceso de fagocitosis, cuando se cliva la membrana de los CD14 (estudios in vitro)
- Sería útil para diagnóstico y monitorización de la respuesta al tratamiento en pacientes sépticos quemados.

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Evaluation of soluble CD14 subtype (presepsin) in burn sepsis

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ABSTRACT

Background: Diagnosing sepsis is difficult in burn patients because of the inflammatory mediators that alter postburn metabolic profile. Here, we compare a new marker presepsin with procalcitonin (PCT), c-reactive protein (CRP) and white blood cell (WBC) in diagnosis and follow up of sepsis in burn patients.

Methods: Patients admitted to burn center of our institute were prospectively investigated. Presepsin, PCT, CRP and WBC levels were measured at admission and every 6 h for first day and daily thereafter. At all timing samples, patients were classified as sepsis or non-sepsis according to the current American Burn Association Consensus Criteria (ABA) 2007.

Result: 37 adult patients were evaluated. A total data of 611 time points were supplied. Sepsis time points differ significantly from non-sepsis in presepsin ($p < 0.0001$), PCT ($p = 0.0012$) and CRP ($p < 0.0001$) levels. Non-surviving patient results differ significantly from survivors in presepsin ($p < 0.0001$), PCT ($p = 0.0210$) and CRP ($p = 0.0008$). AUC-ROC % values for diagnosing sepsis were 83.4% for presepsin, 84.7% for PCT, 81.9% for CRP and 50.8% for WBC. Sepsis patients had significantly different presepsin, CRP and WBC but not PCT levels on their first day of sepsis compared to previous days.

Conclusion: Plasma presepsin levels have comparable performance in burn sepsis.

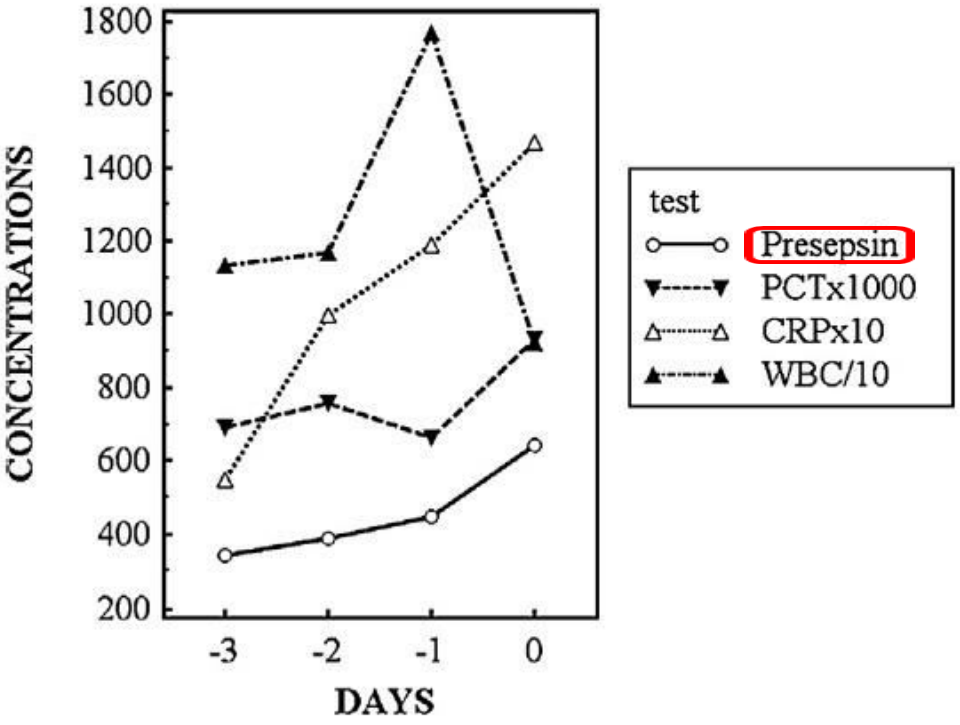

Fig. 2 – Daily monitorization of four markers for 3 days until sepsis day. *Days axis*: −3 (3 days before sepsis). −2 (2 days before sepsis). −1 (1 day before sepsis). 0 (sepsis day). *Concentration axis*: presepsin; pg/mL. PCT; ng/mL. CRP; mg/L. WBC; cells/μL.

- Los niveles de PTC y PCR aumentan en relación a eventos inflamatorios

- Se usan como marcadores de sepsis en quemados, pero no son específicos.

- Dado a la complejidad de la respuesta inflamatoria frente a la sepsis, es improbable que un solo biomarcador sea suficiente para guiar la práctica clínica.

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