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# ASPLENIE: RISQUES INFECTIEUX



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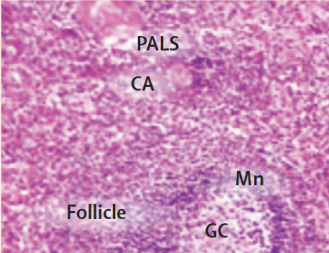
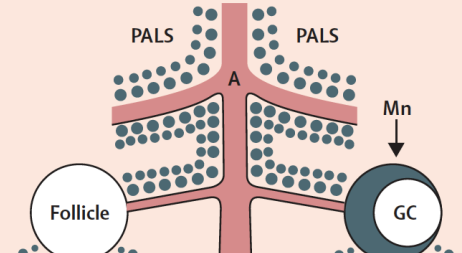
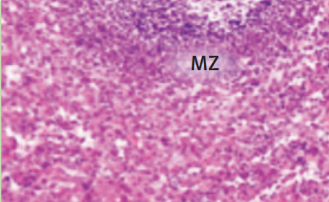
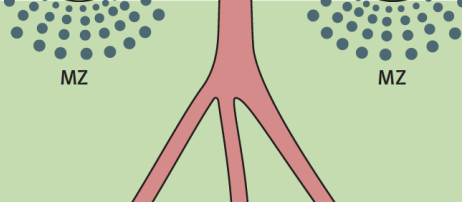
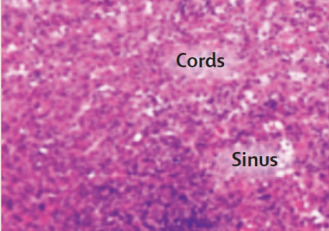
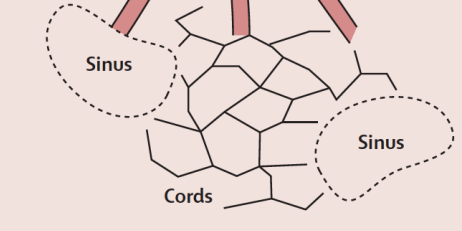
# La rate: organe lymphoïde secondaire

## Asplénie = immunodépression

### Défaut de l'immunité adaptative

atteinte quantitative

atteinte qualitative des cellules B mémoires

| Compartment   | Histology                                                                          | Structure                                                                           | Function                                                                                                                                                                                                                                           | Cell                                                                                                                                                                                                                                |
|---------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| White pulp    |   |   | Adaptive response (antigen specific) consequent to interaction between antigen-presenting cells (dendritic cells or marginal zone B lymphocytes) and B lymphocytes or T lymphocytes                                                                | <b>PALS (T-cell dependent)</b><br>Small CD4 <sup>+</sup> T lymphocytes<br>Dendritic cells<br>B lymphocytes<br>Macrophages<br>Plasma cells<br><b>Follicle (B-cell dependent)</b><br>B lymphocytes or plasma cells<br>Dendritic cells |
| Marginal zone |   |   | Innate response (first-line defence, non-antigen specific) characterised by IgM-memory B-lymphocyte production of natural antibodies                                                                                                               | <b>Resident</b><br>B lymphocytes<br>Macrophages<br><b>In transit</b><br>CD4 <sup>+</sup> T lymphocytes<br>CD27 <sup>+</sup> memory B lymphocytes<br>Dendritic cells                                                                 |
| Red pulp      |  |  | Innate response characterised by activation of macrophages in cords<br><br>Adaptive response characterised by plasma-cell migration from the white pulp after antigen-specific differentiation in follicles<br><br>Blood filter (pitting, culling) | <b>Cords of Billroth</b><br>CD8 <sup>+</sup> T lymphocytes<br>Fibroblasts<br>Macrophages<br>Natural killer cells<br><b>Sinusoids</b><br>CD8 <sup>+</sup> endothelial cells                                                          |

### Défaut de l'immunité innée

défaut d'opsonisation

défaut d'activation du complément

diminution de la capacité de bactéricidie

*Di Sabatino et al. Lancet 2011: 378; 86-97*

*McCarthy et al J Immunol 1995 :155; 387-96*

*Lau and al J Surg Res 1893:34:568-71*

*Kruetzmann and al J Exp Med 2003 :197 :939 -45*

*Kang et al Cytokine 2004;28 ;101-8*

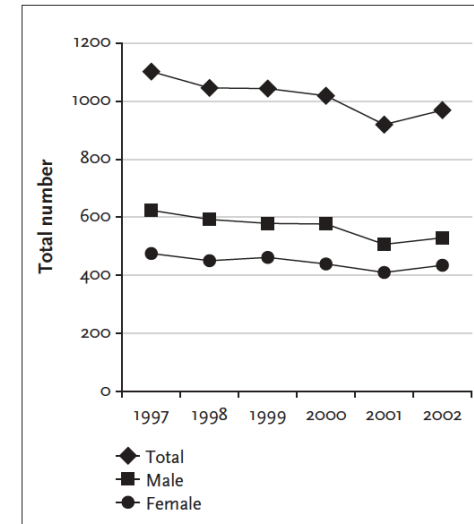
# Asplénie, Hyposplénie, Splénectomie, ...

## totale, partielle, embolisation splénique

Pays-Bas, hôpital universitaire Erasmus, 1998-2002

| INDICATION OF SPLENECTOMY                 | NUMBER (%) |
|-------------------------------------------|------------|
| Haematological and immunological diseases | 73 (31%)   |
| Abdominal malignancies                    | 54 (23%)   |
| Trauma                                    | 38 (16%)   |
| Miscellaneous                             | 57 (24%)   |
| Unknown                                   | 13 (6%)    |
| Total                                     | 235 (100%) |

Melles DC, de Marie S, J Medicine 2004



### France

6000 à 9000 nouveaux patients splénectomisés:

- Splénectomie d'hémostase: 36-37%
- Splénectomie à visée curative: 47-49%
- Splénectomie à visée diagnostique: 17%

CHRU Lille, 2002-2003: 108 splénectomies/7617 chirurgies

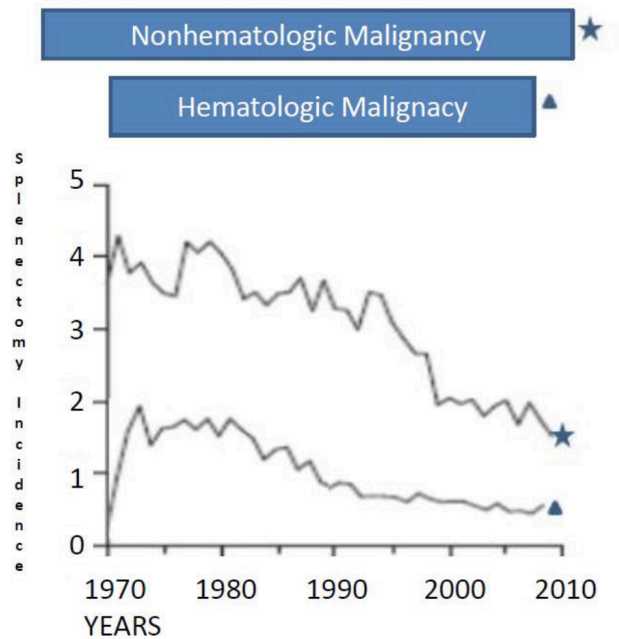
USA: 25000/an, 1 million de personnes asplénique

Allemagne: 8000/an

Splénectomie partielle

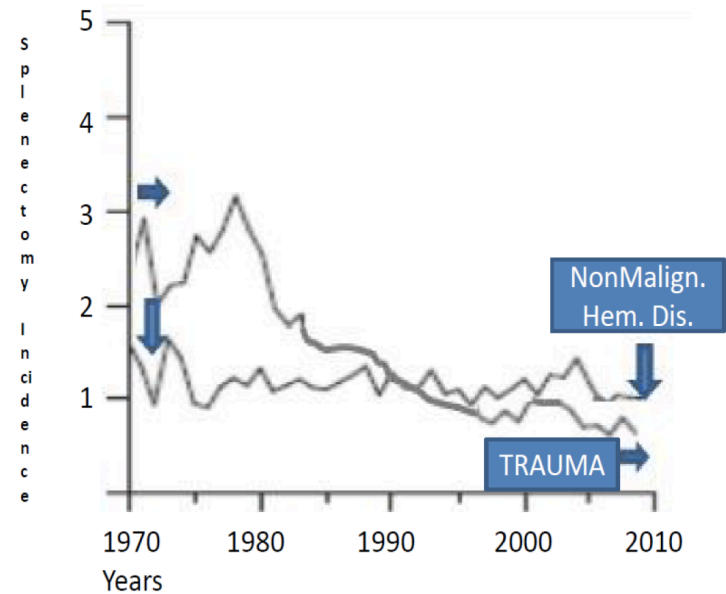
Embolisation de l'artère splénique = alternative à la splénectomie chirurgicale d'étiologie traumatique

# Splénectomie, tendance à la baisse ...



From Edgren, Ann Surg 2014;260:1081–1087 modified

**Figure 1.** Number of splenectomy throughout the recent years.



From Edgren, Ann Surg 2014;260:1081–1087 modified

**Figure 2.** Number of splenectomy throughout the recent years.

# Asplénie, immunodépression, évidence du risque infectieux

- Morris and Bullock, 1919:
  - rats splénectomisés
- King and Schumacker, 1952:
  - 1<sup>ère</sup> description du « Overwhelming Post-Splenectomy Infection (OPSI) »
  - 5 enfants splénectomisés pour sphérocytose
- Dameshek, 1955:
  - Hyposplénisme (maladie coeliaque) et corps de Jolly-Howell

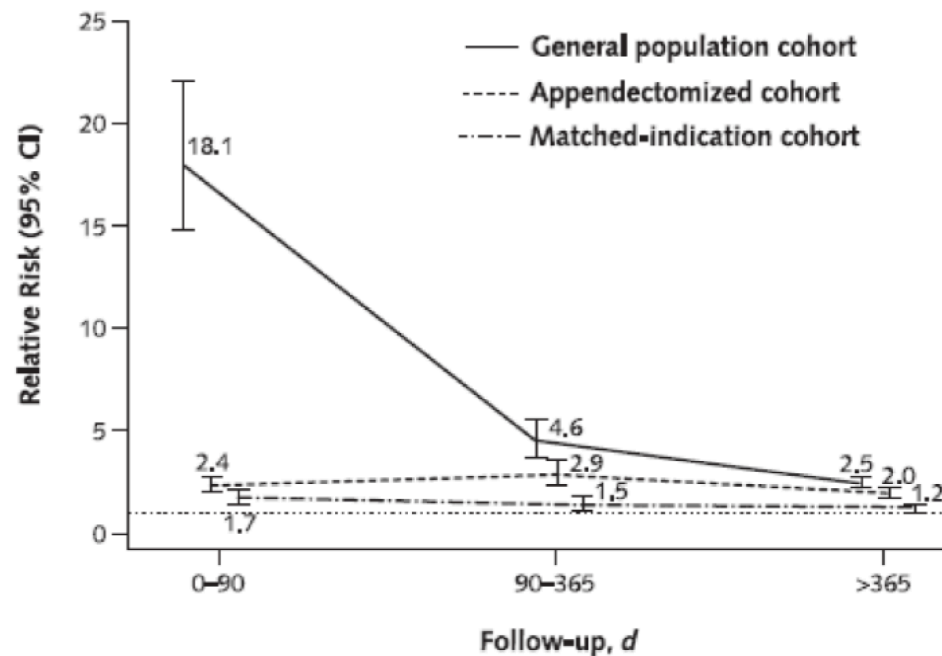
**Table 3.** Rate of severe infections in patients splenectomized for different diseases.

| Authors (ref.) | Nonmalignant Diseases |          |      |        |       |      | Malignant Diseases |          |
|----------------|-----------------------|----------|------|--------|-------|------|--------------------|----------|
|                | Trauma                | ITP      | AIHA | Sphero | Thal. | SCA  | Lymph.             | MPD/MDS  |
| Bisharat (4)   | 2.3%                  | 2.1%     |      | 3.1%   | 8.2%  | 7.3% | 4.1%               |          |
| Thomsen (5)    | 2.5 (RR)              | 4.0      |      | 4.0    |       |      | 5.8                |          |
| Rice (91)      |                       |          |      | 2.5%   |       | 10%  |                    |          |
| Dendle (6)     | 3.12%                 | 4.81%    |      |        |       |      |                    | 13.26    |
| Edgren (8)     | 3.8 (SIR)             | 8.1(SIR) |      |        |       |      |                    | 20 (SIR) |

RR= Relative Risk; SIR= Standardized Incidence Ratio ; Sphero= Spherocytosis;  
 Lymph= Lymphoma; MDP= Myeloproliferative Diseases; MDS= Myelodysplastic Syndromes;  
 ITP= Immune thrombocytopenic Purpura; AIHA= Autoimmune Hemolytic Anemia;  
 Thal.= Thalassemia; SCA= Sickle Cell Anemia.

# Asplénie, immunodépression, évidence du risque infectieux

- Etude danoise
- 3812 splénectomisés, 1996-2005
- Pic d'infections et de mortalité dans les 90 jours post-opératoires
- 20 fois supérieur par rapport au groupe contrôle



From Thomsen et Al. *Ann Intern Med.* 2009;151:546-555.

**Figure 3.** Relative risk of infections after splenectomy with different matchings.

# Postoperative infection risk after splenectomy: A prospective cohort study

Galinos Barmparas, Alexander W. Lamb, Debora Lee, Brandon Nguyen, Jamie Eng, Matthew B. Bloom, Eric J. Ley\*

International Journal of Surgery 17 (2015) 10–14



Los Angeles, 01/2011-07/2013, surgical intensive care unit  
2 groupes: « splénectomie », « chirurgie abdominale sans splénectomie »  
Pas de différence en terme d'âge, de poids, de gravité, d'antécédents médicaux

**Table 2**  
Risk of infectious complications in splenectomy and no splenectomy patients.

|                           | Total (n = 526) | Splenectomy (n = 33) | No splenectomy (n = 493) | p value | Adjusted <sup>a</sup> odds ratio (95% CI) | Adjusted <sup>a</sup> p value |
|---------------------------|-----------------|----------------------|--------------------------|---------|-------------------------------------------|-------------------------------|
| Infectious complications  | 29.8% (157/526) | 48.5% (16/33)        | 28.6% (141/493)          | 0.016   | 2.67 (1.28, 5.59)                         | 0.009                         |
| - VAP                     | 2.3% (12/526)   | 6.1% (2/33)          | 2.0% (10/493)            | 0.170   | 3.56 (0.69, 18.51)                        | 0.131                         |
| - UTI                     | 14.6% (77/526)  | 24.2% (8/33)         | 14.0% (69/493)           | 0.124   | 1.97 (0.83, 4.69)                         | 0.124                         |
| - Bacteremia              | 11.8% (62/526)  | 15.2% (5/33)         | 11.6% (57/493)           | 0.536   | 1.84 (0.65, 5.18)                         | 0.252                         |
| - Wound infection         | 5.7% (30/526)   | 6.1% (2/33)          | 5.7% (28/493)            | 0.712   | 0.84 (0.19, 3.81)                         | 0.821                         |
| - CRBSI                   | 1.9% (10/526)   | 6.1% (2/33)          | 1.6% (8/493)             | 0.125   | 3.94 (0.77, 20.09)                        | 0.100                         |
| - Intra-abdominal abscess | 3.4% (18/526)   | 9.1% (3/33)          | 3.0% (15/493)            | 0.096   | 4.29 (1.14, 16.16)                        | 0.031                         |

# Le syndrome septique post-splénectomie

## Overwhelming Post-Splenectomy Infection (OPSI)

- Complication infectieuse la plus redoutable
- Prévalence: environ 3%, enfants et adultes
- Risque de survenue: 50 fois supérieur par rapport à la population générale
- Mortalité: 1,4 à 2,1%
- Infection très rapidement progressive, liée à une bactériémie d'origine inconnue:
  - Pneumocoque dans 50% des cas
  - Autres: *Haemophilus*, méningocoques, *S. agalactiae*, *Capnocytophaga canimorsus*, *Cryptococcus neoformans*
- Tableau clinique: aspécifique!
  - Fièvre, céphalées, tremblements
  - Signes digestifs, vomissements
  - Algies diffuses, myalgies
- Evolution rapide vers un état de choc septique, avec possibles troubles de coagulation, CIVD, purpura fulminans

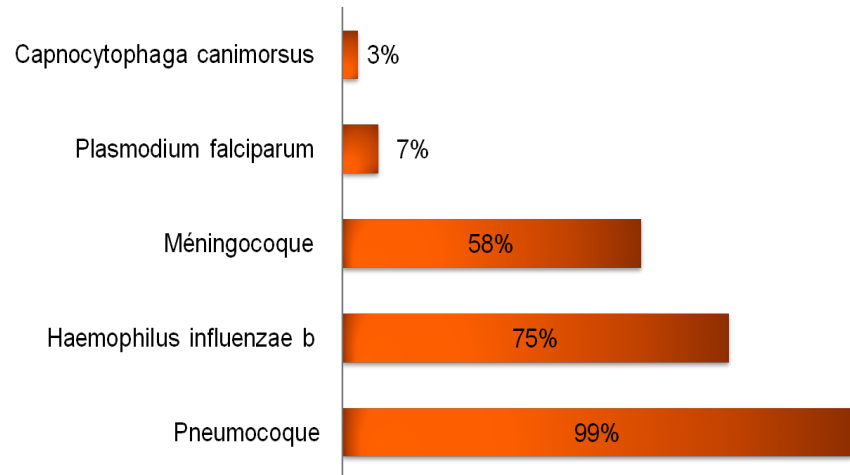


# Asplénisme et risque infectieux, risque méconnu ?

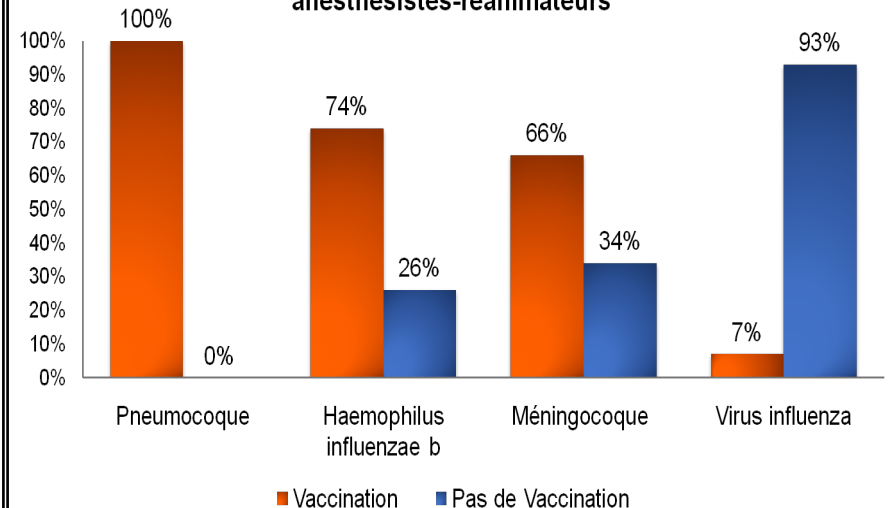
Étude des connaissances des médecins anesthésistes-réanimateurs français concernant la gestion péri-opératoire du patient splénectomisé.

- Enquête faite au CHU de Poitiers du 23/01/2014 au 17/02/2014
- 550 réponses

Connaissances des anesthésistes-réanimateurs des agents infectieux à risque pour le splénectomisé



Vaccinations des patients splénectomisés par les anesthésistes-réanimateurs



# Splénectomie totale versus partielle

- Splénectomie partielle:
  - dépression transitoire de l'immunité humorale, phagocytose normale
- Etudes expérimentales:
  - modèles animaux : 30 % de parenchyme splénique suffirait à maintenir un taux normal de leucocytes
  - Bénéfice de la vaccination +splénectomie partielles (production d'ac)
- Chez l'homme, très peu de données
  - La **quantité minimale** de parenchyme splénique nécessaire à une fonction immunologique correcte est de **25 % minimum**.
  - La splénectomie partielle est particulièrement indiquée (à la place de la splénectomie totale) lorsque les lésions ne concernent que **l'un des deux pôles de la rate**
- Splénectomie partielle pour thalassémie:
  - moins de risque de OPSI chez les patients thalassémiques ayant subi une splénectomie partielle comparativement à la splénectomie totale
  - Pas d'augmentation de la fréquence des infections (étude de suivi à long terme)

Szczepanik AB, Word J Surg 2009

Bessier H, J Sur Res 2004

Lagrand A, Annales francaises d'anesthesie et reanimation 2005

Sheikha AK, Can J Surg 2007 ; 50 : 382-86.

Arvieux C, Encycl Med Chir Techniques chirurgicales - Appareil digestif 2009;(40-750)

# NO FURTHER INCIDENCE OF SEPSIS AFTER SPLENECTOMY FOR SEVERE TRAUMA: A MULTI-INSTITUTIONAL EXPERIENCE OF THE TRAUMA REGISTRY OF THE DGU WITH 1,630 PATIENTS

Eur J Med Res (2010) 15: 258-265

M. Heuer<sup>1</sup>, G. Taeger<sup>2</sup>, G. M. Kaiser<sup>1</sup>, D. Nast-Kolb<sup>2</sup>, C. A. Kühne<sup>3</sup>, S. Ruchholtz<sup>3</sup>, R. Lefering<sup>4</sup>, A. Paul<sup>1</sup>, S. Lendemans<sup>2</sup> and The Trauma Registry of the DGU<sup>5</sup>

*Table 2.* Data analyses of splenic injured patients indexed by AIS spleen and followed treatment option, splenectomy or non-splenectomy.

| AIS spleen   | Patients<br>n | %          | Splenic Injury<br>n | %           | Splenectomy<br>n | %*         | Non-Splenectomy<br>n | %*          |
|--------------|---------------|------------|---------------------|-------------|------------------|------------|----------------------|-------------|
| 0            | 11,803        | 87.9       | 0                   | 0           | 0                | 0          | 0                    | 0           |
| 2            | 1,630         | 12.1       | 295                 | 18.1        | 32               | 10.8       | 263                  | 89.2        |
| 3            |               |            | 457                 | 28          | 106              | 23.2       | 351                  | 76.8        |
| 4            |               |            | 485                 | 29.8        | 316              | 65.2       | 169                  | 34.8        |
| 5            |               |            | 393                 | 24.1        | 304              | 77.4       | 89                   | 22.6        |
| <b>total</b> | <b>13,433</b> | <b>100</b> | <b>1,630</b>        | <b>12.1</b> | <b>758</b>       | <b>5.6</b> | <b>872</b>           | <b>94.4</b> |

*Table 4.* Blood transfusion, sepsis and mortality analyses of studied splenic injured patients.

|                           | Unit  | Splenectomy<br>n = 758 | Non-Splenectomy<br>n = 872 |
|---------------------------|-------|------------------------|----------------------------|
| PRBC                      | units | 8.5                    | 5.0                        |
| >10 PRBC                  | %     | 31.9                   | 19.5                       |
| RR ≤90mmHg (ER)           | %     | 31.7                   | 25.9                       |
| Hb <9mg/dl                | %     | 42.6                   | 31.7                       |
| Organ failure             | %     | 53.0                   | 45.6                       |
| Multiple Organ Failure    | %     | 33.4                   | 29.0                       |
| Sepsis                    | %     | 18.3                   | 18.4                       |
| Mortality within 24 hours | %     | 14.1                   | 13.5                       |
|                           |       | n = 711                | n = 805                    |
| Mortality                 | %     | 25.0                   | 21.5                       |
| RISC                      | %     | 26.7                   | 23.0                       |
| SMR                       |       | 0.94                   | 0.94                       |

*Table 5.* Mortality by AIS spleen and treatment group when survived.

| AIS spleen | Splenectomy | N   | ISS  | OF (%) | MOF (%) | Sepsis (%) | Mortality (%) |
|------------|-------------|-----|------|--------|---------|------------|---------------|
| 2          | Yes         | 32  | 32.4 | 76.5   | 71.6    | 26         | 19            |
|            | No          | 263 | 31.2 | 47.7   | 30.6    | 17         | 12            |
| 3          | Yes         | 106 | 33.4 | 72.7   | 53.2    | 26         | 23            |
|            | No          | 351 | 35.1 | 56.6   | 35.9    | 20         | 19            |
| 4          | Yes         | 316 | 39.5 | 64.4   | 43.0    | 18         | 21            |
|            | No          | 169 | 39.7 | 67.8   | 41.1    | 20         | 25            |
| 5          | Yes         | 304 | 47.9 | 76.0   | 41.0    | 16         | 30            |
|            | No          | 89  | 52.1 | 96.0   | 72.2    | 88         | 58            |

# Preserved function after angioembolisation of splenic injury in children and adolescents: A case control study

*J. Skattum et al./Injury, Int. J. Care Injured 45 (2014) 156–159*

**Table 2**

General blood counts and H-J bodies in the SAE and the control groups.

|                                      | SAE<br><i>n</i> = 11 | Controls<br><i>n</i> = 11 | <i>p</i> | Difference<br>(95% CI) |
|--------------------------------------|----------------------|---------------------------|----------|------------------------|
| Haemoglobin (g/dL)                   | 14.2 (0.9)           | 14.2 (1.1)                | 0.9      | −0.05 (−0.5, 0.4)      |
| Red blood cells (10 <sup>9</sup> /L) | 4.8 (0.2)            | 4.9 (0.3)                 | 0.1      | −0.18 (−0.4, 0.03)     |
| Leukocytes (10 <sup>9</sup> /L)      | 6.3 (1.6)            | 5.5 (1.5)                 | 0.1      | 0.81(−0.6, 2.2)        |
| Neutrophils (10 <sup>9</sup> /L)     | 3.4 (1.1)            | 2.7 (1.1)                 | 0.1      | 0.75 (−0.3, 1.8)       |
| Monocytes (10 <sup>9</sup> /L)       | 0.54 (0.14)          | 0.51 (0.14)               | 0.6      | 0.03 (−0.09, 0.15)     |
| Lymphocytes (10 <sup>9</sup> /L)     | 2.2 (0.6)            | 2.1 (0.9)                 | 0.6      | 0.05 (−0.55, 0.66)     |
| Platelets (10 <sup>9</sup> /L)       | 239 (38)             | 230 (62)                  | 0.7      | 8.5 (−29, 46)          |
| H-J bodies (‰)                       | 0.36 (0.93)          | 0.59 (0.83)               | 0.3      | −0.23 (−1.1, 0.60)     |

**Table 3**

Flowcytometric comparison of lymphocytes between the SAE and the control groups.

|                                                 | SAE<br><i>n</i> = 11 | Controls<br><i>n</i> = 11 | <i>p</i> | Difference<br>(95% CI) |
|-------------------------------------------------|----------------------|---------------------------|----------|------------------------|
| B lymphocytes (CD19) (n/ul)                     | 432 (189)            | 364 (297)                 | 0.2      | 68 (−86, 222)          |
| Memory B cells (CD 27) (%)                      | 20.7 (8.0)           | 22.7 (12.2)               | 0.8      | −2.0 (−12, 8.1)        |
| Ig M <sup>+</sup> CD27 <sup>+</sup> B cells (%) | 12.3 (5.0)           | 13.3 (7.8)                | 0.9      | −1.0 (−7.5, 5.5)       |
| T lymphocytes (CD 4) (n/ul)                     | 1021 (345)           | 911 (373)                 | 0.5      | 109 (−183, 401)        |
| T lymphocytes (CD 3) (n/ul)                     | 1670 (546)           | 1659 (679)                | 0.7      | 11 (−486, 508)         |
| T lymphocytes (CD 8) (n/ul)                     | 538 (179)            | 645 (367)                 | 0.6      | −107 (−359, 145)       |
| NK cells (CD 16 + 56) (n/ul)                    | 215 (66)             | 199 (71)                  | 1.0      | 15 (−57, 88)           |

Anticorps anti-pneumococciques (PPV23): pas de différence  
 Taille de la rate (échographie): pas de différence

# Splenic function after angioembolization for splenic trauma in children and adults: A systematic review

J.A.G. Schimmer<sup>a,\*</sup>, A.F.W. van der Steeg<sup>b</sup>, W.P. Zuidema<sup>a</sup>

*J.A.G. Schimmer et al. / Injury, Int. J. Care Injured 47 (2016) 525–530*



**Table 1**  
Patient demographics and outcome.

|            | Group | N= | Age  | ISS  | Follow-up (yr) | SAE, partial or total | Vaccination <sup>a</sup> | Preserved function? <sup>b</sup> |
|------------|-------|----|------|------|----------------|-----------------------|--------------------------|----------------------------------|
| Bessoud    | SAE   | 37 | 40.0 | 28.8 | 2.2            | Total: 37             | 6                        | Yes                              |
| Falimirski | NOM   | 11 | 24.0 | 23.0 | 3.1            | na                    | na                       | Yes                              |
|            | SP    | 15 | 43.6 | 32.0 | 4.4            |                       |                          |                                  |
|            | C     | 14 | 32.0 | –    | –              |                       |                          |                                  |
| Nakae      | PT    | 34 | 31.7 | 18.0 | 5.7            | na                    | None                     | No                               |
|            | SP    | 24 | 30.4 | 24.0 | 6.7            |                       |                          |                                  |
| Tominaga   | SAE   | 17 | 36.6 | na   | 2.9            | Total: 16             | 1                        | Yes                              |
|            | SP    | 9  | 35.2 | na   | 2.7            | Partial: 1            |                          |                                  |
|            | C     | 10 | 34.4 | –    | –              |                       |                          |                                  |
| Malhotra   | SAE   | 8  | 34.0 | 25.0 | >0.5           | Total: 4              | na                       | Yes                              |
|            | SP    | 4  | 34.0 | 21.0 | >0.5           | Partial: 4            |                          |                                  |
|            | C     | 4  | 34.0 | –    | –              |                       |                          |                                  |
| Shih       | SAE   | 5  | 39.0 | 14.0 | 0              | Partial:5             | na                       | No                               |
|            | C     | 11 | 34.7 | 15.8 | 0              |                       |                          |                                  |
| Walusimbi  | SAE   | 11 | 40.1 | 17.1 | 1.4            | na                    | na                       | Yes                              |
|            | SP    | 21 | 40.3 | 23.5 | na             |                       |                          |                                  |
|            | C     | 20 | 43.5 | 11.9 | –              |                       |                          |                                  |
| Skattum    | SAE   | 15 | 31.7 | 28.3 | 3.1            | na                    | 15                       | Yes                              |
|            | SP    | 14 | 43.6 | 38.5 | 5.4            |                       |                          |                                  |
|            | C     | 29 | na   | –    |                |                       |                          |                                  |
| Pirasteh   | SAE   | 34 | 37.9 | na   | 4.4            | Total: 34             | na                       | Yes                              |
| Skattum    | SAE   | 11 | 12.8 | 17.8 | 4.6            | Total: 10             | None                     | Yes                              |
|            | C     | 11 | na   | –    | –              | Partial: 1            |                          |                                  |
| Olthof     | SAE   | 12 | 38   | 24   | 5              | Total: 5              | None                     | Yes                              |
|            | SP    | na | na   | na   | na             | Partial: 7            |                          |                                  |
|            | C     | na | na   | –    | –              |                       |                          |                                  |
| Foley      | PE    | 38 | 27.5 | na   | na             | Total: 38             | na                       | Yes                              |
|            | DE    | 11 | 34   | na   | na             | Partial: 11           |                          |                                  |
|            | SP    | na | na   | na   | na             |                       |                          |                                  |
|            | C     | na | na   | –    | –              |                       |                          |                                  |

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J.A.G. Schimmer<sup>a,\*</sup>, A.F.W. van der Steeg<sup>b</sup>, W.P. Zuidema<sup>a</sup>

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**Table 4**

Parameters assessing splenic function.

|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bessoud    | Howell–Jolly bodies, serum antibody titre pneumococcus, <i>Haemophilus influenzae</i> B, ultrasound-Doppler                                                                                                                                                                                                                                                                                                                                     |
| Falimirski | Red blood cell pit test, IgM                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Nakae      | Complete blood count, Howell–Jolly bodies, serum ASAT, ALAT, LDH, AF, choline esterase, total cholesterol, total bilirubin, hs-CRP, serum IgA, IgG, IgM), C3, C4, complement haemolytic activity (CH50), lymphocyte subsets CD3, CD4, CD8, CD19, surface immunoglobulins IgA, IgG, IgM, specific anticapsular antibodies against 14 serotypes of <i>S. pneumoniae</i> (types 1, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 12F, 14, 18C, 19F, 23F), CT-abdomen |
| Tominaga   | Complete blood count, IgM, IgG, C3 complement, complement factor B, helper T cells (CD3, CD4), suppressor T-cells (CD8), nuclear medicine spleen scan                                                                                                                                                                                                                                                                                           |
| Malhotra   | CD4+, CD4+CD45RA+, CD4+CD45RO+                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Shih       | NF-kB translocation, phosphorylated I-kB expression, TNF-alpha in Peripheral blood mononuclear cells                                                                                                                                                                                                                                                                                                                                            |
| Walusimbi  | Lymphocyte counts, natural-killer cells, serum complement (C3, C4), properdin                                                                                                                                                                                                                                                                                                                                                                   |
| Skattum    | Complete blood counts, immunoglobulin quantifications, lymphocyte phenotypes and Howell–Jolly bodies, abdominal ultrasound                                                                                                                                                                                                                                                                                                                      |
| Pirasteh   | Howell–Jolly bodies                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Skattum    | Complete blood counts, immunoglobulin quantifications, lymphocyte phenotypes and Howell–Jolly bodies, abdominal ultrasound                                                                                                                                                                                                                                                                                                                      |
| Olthof     | T (CD3, CD4, and CD8), B (CD19 and CD20), and natural killer (NK) lymphocytes count. Antibody response to pneumococcal 23-valent polysaccharide vaccine, B-cell subsets (naïve cells (IgD <sup>+</sup> CD27 <sup>+</sup> ), nonswitched memory B cells (IgD <sup>+</sup> CD27 <sup>+</sup> ), and switched memory B cells (IgD <sup>+</sup> CD27 <sup>+</sup> ), and Howell–Jolly Bodies                                                        |
| Foley      | Splenic volume (assessed by CT) and IgM memory B cells (as % of total B cells)                                                                                                                                                                                                                                                                                                                                                                  |

# Facteurs de risques d'infection

## Risk of Infection and Death Among Post-splenectomy Patients

N. Bisharat<sup>1,\*</sup> H. Omari<sup>2</sup>, I. Lavi<sup>3</sup> and R. Raz<sup>4</sup>

**Table II.** The incidence of infection and death according to age and underlying disease.

| Underlying disease  | No. of patients |        | Infections (%) |           | Deaths (%) |          |
|---------------------|-----------------|--------|----------------|-----------|------------|----------|
|                     | Children        | Adults | Children       | Adults    | Children   | Adults   |
| Trauma              | 1641            | 1901   | 33 (2)         | 50 (2.6)  | 13 (0.8)   | 20 (1)   |
| Spherocytosis       | 295             | 808    | 8 (2.7)        | 29 (3.5)  | 4 (1.3)    | 11 (1.4) |
| ITP                 | 194             | 283    | 5 (2.6)        | 6 (2.1)   | 3 (1.5)    | 3 (1.1)  |
| Hodgkin's lymphoma  | 270             | 322    | 10 (3.7)       | 15 (4.6)  | 5 (1.8)    | 6 (1.9)  |
| Thalassaemia major  | 190             | 81     | 22 (11.6)      | 6 (7.4)   | 14 (7.3)   | 3 (3.7)  |
| Sickle-cell anaemia | 101             | 78     | 9 (8.9)        | 5 (6.4)   | 7 (6.1)    | 3 (3.8)  |
| Other <sup>1</sup>  | 32              | 408    | 2 (6.3)        | 12 (2.9)  | 1 (3.1)    | 4 (1.1)  |
| Total               | 2723            | 3881   | 89 (3.3)       | 123 (3.2) | 47 (1.7)   | 50 (1.3) |

# **Postsplenectomy sepsis and its mortality rate: actual *versus* perceived risks**

R. J. Holdsworth,  
A. D. Irving\* and  
A. Cuschieri

**Table 1** Overall incidence of reported postsplenectomy infection and mortality in well documented cases (n = 5902)

| Age group<br>(years) | Patients | Infections | Deaths   |
|----------------------|----------|------------|----------|
| Children < 16        | 2974     | 131 (4.4)  | 66 (2.2) |
| Adults > 16          | 1782     | 16 (0.9)   | 15 (0.8) |
| Not specified        | 1146     | 26 (2.3)   | 10 (0.9) |
| Total                | 5902     | 173 (2.9)  | 91 (1.5) |

**Table 3** Incidence of sepsis and mortality in infants after splenectomy. Based on 795 children undergoing the operation under 5 years old

| Series                                | Age<br>(years) | Patients | Infections | Deaths   |
|---------------------------------------|----------------|----------|------------|----------|
| Present review                        | < 5            | 795      | 83 (10.4)  | 36 (4.5) |
| Present review                        | < 1            | 134      | 21 (15.7)  | 9 (6.7)  |
| Broberger <i>et al.</i> <sup>15</sup> | < 1            | 56       | 13 (23.2)  | 7 (12.5) |
| Erickson <i>et al.</i> <sup>30</sup>  | < 1            | 68       | 12 (17.6)  | 6 (8.8)  |



# Facteurs de risques d'infection

**Table 6** *Interval to first infection. Based on 288 individual patients with full details*

| Interval from splenectomy | All infections | Pneumococcal infections |
|---------------------------|----------------|-------------------------|
| 0-6 months                | 50 (17.4)      | 23 (14.4)               |
| 7-12 months               | 41 (14.2)      | 18 (11.3)               |
| 1-2 years                 | 59 (20.5)      | 33 (20.6)               |
| 2-3 years                 | 25 (8.7)       | 13 (8.1)                |
| 3-4 years                 | 25 (8.7)       | 18 (11.3)               |
| 4-5 years                 | 13 (4.5)       | 3 (1.9)                 |
| 5-10 years                | 48 (16.7)      | 34 (21.3)               |
| 11-15 years               | 16 (5.5)       | 10 (6.3)                |
| 16-20 years               | 2 (0.7)        | 2 (1.3)                 |
| > 20 years                | 9 (3.1)        | 6 (3.8)                 |
| Total                     | 288            | 160                     |

**Table 5** *Frequency of first infections at different ages of patients at time of infection. Data based on 281 first episodes of infection where full details were available*

| Age (years) | All infections | Pneumococcal infections | Percentage pneumococcal of all infections |
|-------------|----------------|-------------------------|-------------------------------------------|
| < 5         | 62 (22.1)      | 24 (15.0)               | 38.7                                      |
| 6-10        | 49 (17.4)      | 28 (17.5)               | 57.1                                      |
| 11-15       | 34 (12.1)      | 20 (12.5)               | 58.8                                      |
| 16-20       | 18 (6.4)       | 4 (2.5)                 | 22.2                                      |
| 21-30       | 31 (11.0)      | 22 (13.8)               | 71.0                                      |
| 31-40       | 25 (8.9)       | 20 (12.5)               | 80.0                                      |
| 41-50       | 23 (8.2)       | 15 (9.4)                | 65.2                                      |
| 51-60       | 17 (6.0)       | 9 (5.6)                 | 52.9                                      |
| > 61        | 22 (7.8)       | 18 (11.3)               | 81.8                                      |
| Total       | 281            | 160 (56.9)              |                                           |

# Facteurs de risques d'infection

## Risque infectieux post-opératoire précoce et type de splénectomie

|                                  | Risque de complications infectieuses* | Mortalité |
|----------------------------------|---------------------------------------|-----------|
| Splénectomie réalisée en urgence | 30%                                   | 13%       |
| Splénectomie Programmée          | 6,4%                                  | 1%        |

\* Infections respiratoires, abcès de paroi, surinfections d'hématomes abdominaux

# Etiologies microbiennes

n = 349 épisodes infectieux / 5902 patients

| Agent pathogène                 | Infection (%) | Décès/agent pathogène (%) |
|---------------------------------|---------------|---------------------------|
| <i>Streptococcus pneumoniae</i> | 56,7          | 57,6                      |
| <i>Haemophilus influenzae</i>   | 6,3           | 31,8                      |
| <i>Neisseria meningitidis</i>   | 3,7           | 61,5                      |
| <i>Escherichia coli</i>         | 3,7           | 76,9                      |
| <i>Streptococci</i>             | 3,1           | 27,3                      |
| <i>Pseudomonas</i>              | 2,6           | 77,8                      |
| <i>Staphylococci</i>            | 2,0           | 28,6                      |
| Bacilles à Gram négatif         | 2,0           | 28,6                      |
| Infections fongiques            | 5,2           | 50,0                      |
| Non identifié                   | 14,6          | 62,0                      |

- 80% des infections graves surviennent dans les 2 à 3 ans post -op
- Des infections fulminantes ont été décrites 30 ans après la splénectomie

# Overwhelming Postsplenectomy Infection: A Prospective Multicenter Cohort Study

Christian Theilacker,<sup>1,2,a</sup> Katrin Ludewig,<sup>5</sup> Annerose Serr,<sup>3</sup> Julia Schimpf,<sup>3</sup> Jürgen Held,<sup>3,7</sup> Martin Bögelein,<sup>1,2,4</sup> Viola Bahr,<sup>5</sup> Stephan Rusch,<sup>4</sup> Annette Pohl,<sup>1,4</sup> Klaus Kogelmann,<sup>8</sup> Sigrun Frieeseke,<sup>9</sup> Ralph Bogdanski,<sup>10</sup> Frank M. Brunkhorst,<sup>5,6,b</sup> and Winfried V. Kern<sup>2,b</sup>; for the Splenectomy, Pneumococcus, and Fulminant Infection (SPLEEN OFF) Study Group<sup>c</sup>

Allemagne, 173 ICU  
Choc septique communautaire

Groupe asplénie:  
plus d'ATCD de cancer,  
IMC plus bas

**Table 3. Infection Focus, Sepsis Severity, and Outcomes**

| Parameter                               | Asplenia<br>(n = 52) | No Asplenia<br>(n = 52) | P<br>Value  |
|-----------------------------------------|----------------------|-------------------------|-------------|
| <b>Infection focus<sup>a</sup></b>      |                      |                         |             |
| Primary bacteremia (no site)            | 6 (12)               | 0 (0)                   | <b>.012</b> |
| Respiratory tract                       | 21 (40)              | 27 (52)                 | .330        |
| Intra-abdominal                         | 13 (25)              | 8 (15)                  | .225        |
| Urinary tract                           | 1 (2)                | 5 (10)                  | .205        |
| Central nervous system                  | 4 (8)                | 3 (6)                   | .713        |
| Skin/soft tissue                        | 0 (0)                | 6 (12)                  | <b>.012</b> |
| Other/not specified                     | 7 (13)               | 3 (6)                   | .483        |
| <b>Sepsis severity on admission</b>     |                      |                         |             |
| APACHE II score <sup>b,c</sup>          | 23 (16–29)           | 25 (19–33)              | .069        |
| SOFA score <sup>b,d</sup>               | 10 (8–13)            | 11 (8–14)               | <b>.047</b> |
| Metabolic acidosis <sup>e</sup>         | 34 (65)              | 37 (71)                 | .826        |
| Procalcitonin level, ng/mL <sup>b</sup> | 34 (3–98)            | 15 (2–54)               | .236        |
| Lactate, mmol/L <sup>b</sup>            | 4.9 (1.9–10.1)       | 2.8 (1.6–6.4)           | .106        |
| Purpura fulminans                       | 10 (19)              | 3 (5)                   | <b>.038</b> |
| <b>Outcomes</b>                         |                      |                         |             |
| Days on ICU <sup>f</sup>                | 13 (3–23)            | 18 (11–25)              | .106        |
| Days in hospital <sup>f</sup>           | 29 (26–32)           | 31 (26–36)              | .327        |
| Days on ventilator <sup>f</sup>         | 6 (1–11)             | 12 (7–16)               | <b>.030</b> |
| 7-day mortality <sup>g</sup>            | 11 (21)              | 6 (12)                  | .289        |
| 28-day mortality <sup>h</sup>           | 18 (35)              | 18 (35)                 | 1.000       |

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**Table 2. Microorganisms Causing Infection With Severe Sepsis/Septic Shock in Patients With and Without Asplenia**

| Characteristic                     | Bloodstream Infection |                      |             | All Infections    |                      |                 |
|------------------------------------|-----------------------|----------------------|-------------|-------------------|----------------------|-----------------|
|                                    | Asplenia (n = 52)     | No Asplenia (n = 52) | P Value     | Asplenia (n = 52) | No Asplenia (n = 52) | P Value         |
| Gram-positive pathogen             | 19 (37)               | 11 (21)              | .098        | 26 (50)           | 18 (35)              | .157            |
| <i>Streptococcus pneumoniae</i>    | 16 (31)               | 3 (6)                | <b>.002</b> | 22 (42)           | 6 (12)               | <b>&lt;.001</b> |
| <i>Staphylococcus aureus</i>       | . . .                 | 3 (6)                | .243        | 1 (2)             | 7 (14)               | .060            |
| <i>Streptococcus pyogenes</i>      | . . .                 | 3 (6)                | .243        | . . .             | 3 (6)                | .243            |
| Other <i>Streptococcus</i> species | 2 (4)                 | . . .                | .495        | 2 (4)             | . . .                | .495            |
| Other gram-positive pathogens      | 1 (2)                 | 2 (4)                | 1.000       | 1 (2)             | 2 (4)                | 1.000           |
| Gram-negative pathogen             | 4 (8)                 | 8 (15)               | .098        | 6 (12)            | 10 (19)              | .157            |
| <i>Escherichia coli</i>            | . . .                 | 7 (14)               | .118        | 3 (6)             | 7 (14)               | .319            |
| <i>Klebsiella</i> species          | 2 (4)                 | . . .                | .495        | 2 (4)             | 1 (2)                | 1.000           |
| <i>Pseudomonas aeruginosa</i>      | 1 (2)                 | 1 (2)                | 1.000       | 1 (2)             | 1 (2)                | 1.000           |
| Other gram-negative pathogens      | 1 (2)                 | . . .                | 1.000       | . . .             | 1 (2)                | 1.000           |
| Polymicrobial <sup>a</sup>         | 3 (6)                 | . . .                | .243        | 6 (12)            | 2 (4)                | .269            |
| Virus                              | . . .                 | . . .                | . . .       | . . .             | 3 (6)                | .286            |
| No pathogen identified             | 26 (50)               | 33 (64)              | .235        | 14 (27)           | 19 (37)              | .400            |

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**Table 4. Variables Associated With Pneumococcal Infection in Patients With Severe Sepsis or Septic Shock**

| Variable                                               | Patients Without<br>Pneumococcal Sepsis<br>(n = 76) | Patients With<br>Pneumococcal Sepsis<br>(n = 28) | Univariate Analysis     |                    |             | Multivariate Analysis |                    |             |
|--------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------|-------------------------|--------------------|-------------|-----------------------|--------------------|-------------|
|                                                        |                                                     |                                                  | RR                      | 95% CI             | P Value     | Adjusted RR           | 95% CI             | P Value     |
| Age ≥70 years                                          | 18 (24)                                             | 5 (18)                                           | <b>0.97<sup>a</sup></b> | <b>(.95–1.00)</b>  | .028        | 0.99 <sup>a</sup>     | (.96–1.01)         | .198        |
| Male sex                                               | 44 (58)                                             | 14 (50)                                          | 0.79                    | (.42–1.49)         | .510        |                       |                    |             |
| Body mass index ≤20 kg/m <sup>2</sup>                  | 8 (13)                                              | 2 (8)                                            | <b>0.94<sup>a</sup></b> | <b>(.89–.99)</b>   | .017        | 0.96 <sup>a</sup>     | (.91–1.02)         | .173        |
| Current smoking                                        | 22 (29)                                             | 10 (36)                                          | 1.25                    | (.65–2.40)         | .632        |                       |                    |             |
| Alcohol use                                            | 14 (18)                                             | 3 (11)                                           | 0.61                    | (.21–1.81)         | .550        |                       |                    |             |
| Asplenia                                               | 30 (39)                                             | 22 (79)                                          | <b>3.67</b>             | <b>(1.62–8.30)</b> | <b>.001</b> | <b>2.50</b>           | <b>(1.07–5.84)</b> | <b>.034</b> |
| Previous hospitalization due to infection <sup>b</sup> | 24 (32)                                             | 7 (25)                                           | 0.79                    | (.37–1.65)         | .632        |                       |                    |             |
| Charlson comorbidity index ≥5                          | 17 (22)                                             | 4 (14)                                           | 0.89 <sup>a</sup>       | (.75–1.06)         | .177        |                       |                    |             |
| History of malignancy                                  | 22 (29)                                             | 8 (29)                                           | 0.99                    | (.49–1.99)         | 1.000       |                       |                    |             |
| Active neoplastic disease                              | 7 (10)                                              | 2 (7)                                            | 0.81                    | (.23–2.87)         | 1.000       |                       |                    |             |
| Immunosuppressive therapy                              | 7 (10)                                              | 0 (0)                                            | 0.21                    | (.01–3.20)         | .118        |                       |                    |             |
| Antineoplastic chemotherapy                            | 5 (7)                                               | 0 (0)                                            | 0.29                    | (.02–4.23)         | .367        |                       |                    |             |
| Pneumococcal vaccination (any time)                    | 18 (24)                                             | 8 (29)                                           | 1.20                    | (.60–2.39)         | .617        |                       |                    |             |

# Asplenic patients and invasive pneumococcal disease—how bad is it these days?



Thomas J. Marrie<sup>a</sup>, Gregory J. Tyrrell<sup>b</sup>, Sumit R. Majumdar<sup>c</sup>, Dean T. Eurich<sup>d,\*</sup>

International Journal of Infectious Diseases 51 (2016) 27–30

Northern Alberta, Canada,  
Etude prospective, 2000-2014  
Toute IPD, n = 2435 cas

**Table 1**

Comparison of IPD patients with no spleen and IPD patients with a spleen

|                              | No spleen   | Spleen       | <i>p</i> -Value    |
|------------------------------|-------------|--------------|--------------------|
| Number                       | 37 (1.5%)   | 2398 (98.5%) | –                  |
| Age, years, mean (SD)        | 58.6 (13.7) | 54.2 (17.9)  | 0.13               |
| Male                         | 18 (49%)    | 1362 (57%)   | 0.32               |
| Aboriginal                   | 0 (0%)      | 312 (13%)    | 0.011 <sup>a</sup> |
| Living at home               | 36 (97%)    | 1924 (81%)   | 0.026 <sup>a</sup> |
| Homeless                     | 0 (0%)      | 184 (8%)     |                    |
| Fully functional             | 28 (76%)    | 1727 (72%)   | 0.62               |
| Current smoker               | 8 (22%)     | 1096 (46%)   | 0.003              |
| Cancer past 5 years          | 12 (32%)    | 295 (12%)    | <0.001             |
| Hepatitis C                  | 1 (3%)      | 306 (13%)    | 0.078              |
| Chronic renal failure        | 3 (8%)      | 124 (5%)     | 0.44               |
| HIV infection                | 0           | 117 (5%)     | 0.25 <sup>a</sup>  |
| Systemic lupus erythematosus | 1 (3%)      | 16 (1%)      | 0.23               |
| COPD                         | 3 (8%)      | 438 (18%)    | 0.13               |
| Alcoholism                   | 4 (11%)     | 616 (26%)    | 0.039              |
| Illicit drug use             | 1 (3%)      | 481 (20%)    | 0.006              |

# Asplenic patients and invasive pneumococcal disease—how bad is it these days?



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International Journal of Infectious Diseases 51 (2016) 27–30

**Table 2**

Outcomes of IPD amongst patients with and without a spleen

|                          | No spleen (37 cases) | Spleen (2398 cases) | <i>p</i> -Value |
|--------------------------|----------------------|---------------------|-----------------|
| Intensive care admission | 19 (51.4%)           | 664 (27.7%)         | 0.001           |
| Mechanical ventilation   | 15 (40.5%)           | 532 (22.2%)         | 0.008           |
| Meningitis               | 8 (21.6%)            | 112 (4.7%)          | <0.001          |
| Cellulitis               | 1 (2.7%)             | 64 (2.7%)           | 1               |
| Osteomyelitis            | 0                    | 7 (0.3%)            | 1               |
| Septic arthritis         | 1 (2.7%)             | 39 (1.6%)           | 0.46            |
| Acute kidney injury      | 7 (18.9%)            | 92 (3.8%)           | <0.001          |
| Liver failure            | 2 (5.4%)             | 60 (2.5%)           | 0.24            |
| Died in hospital         | 7 (18.9%)            | 374 (15.6%)         | 0.58            |

**Table 3**

The two most frequent pneumococcal serotypes causing IPD amongst 37 patients with no spleen and 2398 with a spleen

| Serotype | No spleen  | Spleen     | <i>p</i> -Value |
|----------|------------|------------|-----------------|
| 23B      | 10 (27.0%) | 20 (0.8%)  | <0.0001         |
| 22F      | 7 (18.9%)  | 169 (7.0%) | 0.006           |
| Total    | 17 (45.9%) | 189 (7.8%) |                 |



# Conclusion

- Asplénie = augmentation du risque infectieux
  - Maximal dans les 2 ans suivants la splénectomie, mais possible toute la vie
  - Plus important chez le jeune enfant
  - Plus important si splénectomie d'indication médicale
- OPSI:
  - Clinique non spécifique
  - Evolution foudroyante
  - Mortalité proche de 50%
- Etiologie
  - Pneumocoque en priorité
  - Toutes bactéries encapsulées
  - Parasites: *Plasmodium*, *Babesia*

CLINICAL PRACTICE

Caren G. Solomon, M.D., M.P.H., *Editor*

# Care of the Asplenic Patient

Lorry G. Rubin, M.D., and William Schaffner, M.D.

**A 23-year-old man sustained abdominal trauma in a motorcycle accident that required a surgical splenectomy. He received the 23-valent pneumococcal polysaccharide vaccine (PPSV23) after surgery. Six months after his surgery, he calls his primary care provider because he has fever. What is the appropriate management? Are other prophylactic measures available and indicated?**