CaesarStone® silicosis epidemic: Atypical pathological presentation

N. Abdel-rahman, A. Amital, D. Shitrit
Y. Raviv, MR. Kramer
SILEX
Visconti - 1870

Кремень  صوان  زور  Flint
Silicon dioxide- SiO₂
Bernardino Ramazzini (1633-1714) in early 18th century.
“...when the bodies of such workers are dissected, they have been found to be stuffed with small stones.”

Diseases of Workers (De Morbis Artificum Diatriba, 1713).
CaesarStone® silicosis: Disease resurgence among artificial stone workers

Mordechai R. Kramer, Paul D. Blanc,*, Elizabeth Fireman, Anat Amital Alexander Guber, Nader Abdel Rahman, David Shitrit

Chest 2012: In press
The Israeli Cesar stone epidemic

The bar chart shows the number of cases of the Cesar stone epidemic in Israel from 1997 to 2011. The highest number of cases occurred in 2009.
Nota clínica

Silicosis, una enfermedad con presente activo

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b Servicio de Radiodiagnóstico, Instituto Nacional de Silicosis (INS), Hospital Universitario Central de Asturias (HUCA), Oviedo, Asturias, España
c Departamento de Ingeniería, Instituto Nacional de Silicosis (INS), Hospital Universitario Central de Asturias (HUCA), Oviedo, Asturias, España

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Palabras clave:
Silicosis
Historia laboral
Conglomerados de silice cristalina

RESUMEN

La silicosis, enfermedad pulmonar intersticial causada por la inhalación de polvo de silice cristalina, a pesar de ser una de las enfermedades de origen ocupacional más antiguas, continúa siendo causa de morbimidad y mortalidad en todo el mundo. La Organización Mundial de la Salud y la Organización Internacional del Trabajo (OMS/OIT), conscientes de la vigencia del problema, han diseñado el Programa Mundial para la Eliminación de la Silicosis, que incluye entre sus acciones la identificación de los grupos de trabajadores en riesgo. Presentamos 3 casos de silicosis en trabajadores jóvenes del sector de la construcción, con exposición a concentraciones elevadas de silice por manipulación de conglomerados artificiales de silice. El principal interés de esta observación radica en la identificación de nuevas fuentes de riesgo, en la necesidad de llamar la atención sobre la peligrosidad que entraña su uso sin medidas de prevención, y en la importancia de la historia laboral para evitar el infradiagnóstico.

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SILICOSIS: A DISEASE WITH AN ACTIVE PRESENT

ABSTRACT

Silicosis, an interstitial lung disease caused by the inhalation of crystalline silica powder, despite being one of the oldest occupational diseases, continues being a cause of morbidity and mortality all over the world. The World Health Organisation and the International Labour Organisation (OMS/OIT), aware of the current problem, have designed the World Programme for the Elimination of Silicosis, which includes the identification of occupational groups at risk amongst its actions. We present 3 cases of silicosis in young workers in the construction sector, with exposure to high concentrations of silica due to handling artificial silica conglomerates. The main interest of this observation lies in the identification of new risk sources, in the need to draw attention to the dangers involved in its use without prevention measures, and in the importance of the occupational history to avoid under-diagnosis.

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Case #1

- 45 old male
- 16 year occupational exposure to CaesarStone ® as marble stone worker: Cutting and Polishing.
- Rheumatoid arthritis
- Smoking history - 15 years.
- Persistent cough, fever, weight loss.
Case #1

RABIN MEDICAL CENTER
Beilinson Hospital Pulmonary Institute
Tel: 03-9377221 Fax: 03-9242091
Chief: Prof. M. Kramer

Family name: First name: Height: 174 cm Weight: 62 kg
ID: 00002220000 Sex: Male
Birthdate: 01.01.1965- RDI: 10.10.2011 / 10:25 h
Physician: Date: 10.10.2011 / 10:25 h
Technician: Comment:

Flow-VOLUME / CO-Diffusion / Bodyplethysmography

Flow-VOLUME:

<table>
<thead>
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<th>unit</th>
<th>pred</th>
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<th>%pred</th>
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<td>41</td>
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<tr>
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<td>l</td>
<td>3.69</td>
<td>1.53</td>
<td>41</td>
</tr>
<tr>
<td>FEV6</td>
<td>l</td>
<td>3.47</td>
<td>1.64</td>
<td>41</td>
</tr>
<tr>
<td>FEV1/FVC%</td>
<td></td>
<td>70</td>
<td>82</td>
<td>104</td>
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<tr>
<td>PEF</td>
<td>l/s</td>
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<td>MEF75</td>
<td>l/s</td>
<td>7.73</td>
<td>4.39</td>
<td>57</td>
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<tr>
<td>MEF25</td>
<td>l/s</td>
<td>2.03</td>
<td>0.61</td>
<td>30</td>
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<tr>
<td>MEF25-75</td>
<td>l/s</td>
<td>1.14</td>
<td>0.49</td>
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Bodyplethysmography:

<table>
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<th>%act.</th>
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<tbody>
<tr>
<td>VC</td>
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<td>1.84</td>
</tr>
<tr>
<td>IC</td>
<td>l</td>
<td>3.43</td>
<td>1.21</td>
</tr>
<tr>
<td>ERV</td>
<td>l</td>
<td>1.35</td>
<td>0.63</td>
</tr>
<tr>
<td>TGV</td>
<td>l</td>
<td>3.39</td>
<td>1.81</td>
</tr>
<tr>
<td>TLC</td>
<td>l</td>
<td>6.92</td>
<td>3.02</td>
</tr>
<tr>
<td>RV</td>
<td>l</td>
<td>2.04</td>
<td>1.18</td>
</tr>
<tr>
<td>RV/TLC%</td>
<td></td>
<td>32</td>
<td>39</td>
</tr>
<tr>
<td>RAWtot</td>
<td>kPa (l/s)</td>
<td>0.30</td>
<td>0.52</td>
</tr>
<tr>
<td>sGAWtot</td>
<td>kPa (l/s)</td>
<td>1.39</td>
<td>1.74</td>
</tr>
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</table>

CO-Diffusion:

<table>
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<tr>
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<th>unit</th>
<th>act.</th>
<th>%act.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HB</td>
<td>g/dl</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>DLco(Hb)</td>
<td>ml/min/mmHg</td>
<td>30.91</td>
<td>12.12</td>
</tr>
<tr>
<td>Aco(Hb)</td>
<td>ml/min/mmHg</td>
<td>4.55</td>
<td>4.19</td>
</tr>
</tbody>
</table>

Comment: sat-96%
Case #1
Case #1
Case #1
Case #1
Case #1
Case #1 (cont)

- Open lung biopsy suspected B cell lymphoma
- 6 courses of R-CHOP
- Worsening dyspnea, Hypoxemia
- Biopsy revision- silicosis PMF
- Referred for lung transplantation
2* -SILICOTIC NODULE  Case #1
4* -SILICOTIC NODULE  Case #1
SILICOTIC NODULE

Case #1

10× - SILICOTIC NODULE Case #1
RIGHT LUNG:
- END STAGE LUNG DISEASE WITH FEATURES COMPATIBLE WITH SILICOSIS WITH PROGRESSIVE MASSIVE FIBROSIS:
- LUNG REPLACED BY CONGLOMERATES OF CONCENTRIC ACCELLULAR WHORLED BUNDLES OF DENSE HYLINIZED COLLAGEN FIBERS WITH DUST LADEN MACROPHAGES WITH WEAK POLARIZAITON POSITIVITY.
- THE NODULES ARE SURROUNDED BY CHRONIC INFLAMMATION RICH IN PLASMA CELLS AND FIBROSIS.
- SIGNS OF PULMONARY HYPERTENSION WITH THICKENING OF ARTERIOLAR WALL DUE TO INTIMA AND MEDIA PROLIFERATION OF SMOOTH MUSCLE CELLS.
- THE HILAR LYMPH NODEA ARE EXTENSIVELY INVOLVED BY ADVANCED SILICOTIC NODULES WITH FOCAL CALCIFICATIONS.
אלקטרומיקרוסקופיה-SEM

Full scale = 6.26 k counts  
Cursor: 1.7475 keV

Si
לאחר השתלת ריאה ימנית
לתקוףikan 6 שבועות Minh

[08/08/2011 09]
GE MEDICAL SYSTEMS LH46

[08/08/2011 09]
GE MEDICAL SYSTEMS LH46
סיליקוזיס – לימפומה

• לימפואדנופתיה דו צדדי
t
• B symptoms
• קליטת PET
• ביופסי娅 לא חדה משמעית

בנכות חוד שבעה מושכת עם סיליקה
- אבונ קריס האבחנה הייא סיליקוזיס!!
Case # 2

- 45 Male
- 20 years of exposure to CaesarStone ®
- Cutting and Polishing.
- Smoking history for 18 years.
- Cough
- Shortness of breath
- X-ray changes
Flow-Volume Pre/Post / CO-Diffusion / Bodysplethysmography

Flow-Volume:

<table>
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<tr>
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<th>Pre % Pred.</th>
<th>Post % Pred.</th>
<th>Post % Pred.</th>
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<td>l</td>
<td>4.45</td>
<td>2.02</td>
<td>2.08</td>
<td>47</td>
</tr>
<tr>
<td>FEV1</td>
<td>l</td>
<td>3.65</td>
<td>1.38</td>
<td>1.39</td>
<td>38</td>
</tr>
<tr>
<td>FEV6</td>
<td>l</td>
<td>2.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>%</td>
<td>78</td>
<td>68</td>
<td>67</td>
<td>84</td>
</tr>
<tr>
<td>PEF</td>
<td>l/s</td>
<td>8.84</td>
<td>4.12</td>
<td>3.96</td>
<td>45</td>
</tr>
<tr>
<td>MEF25</td>
<td>l/s</td>
<td>7.67</td>
<td>2.76</td>
<td>2.79</td>
<td>36</td>
</tr>
<tr>
<td>MEF50</td>
<td>l/s</td>
<td>4.81</td>
<td>0.96</td>
<td>1.01</td>
<td>21</td>
</tr>
<tr>
<td>MEF25-75</td>
<td>l/s</td>
<td>2.01</td>
<td>0.37</td>
<td>0.29</td>
<td>15</td>
</tr>
<tr>
<td>FVCin</td>
<td>l</td>
<td>4.64</td>
<td>1.46</td>
<td>1.67</td>
<td>36</td>
</tr>
<tr>
<td>MEF50</td>
<td>l/s</td>
<td>5.11</td>
<td>3.11</td>
<td>3.03</td>
<td>59</td>
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Bodyplethysmography:

<table>
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<th>Parameter</th>
<th>Unit</th>
<th>Pred.</th>
<th>Pre % Pred.</th>
<th>Post % Pred.</th>
<th>Post % Pred.</th>
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<tbody>
<tr>
<td>VC</td>
<td>l</td>
<td>4.64</td>
<td>2.05</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>IC</td>
<td>l</td>
<td>3.37</td>
<td>1.51</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>ERV</td>
<td>l</td>
<td>1.34</td>
<td>0.54</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>TGV</td>
<td>l</td>
<td>3.36</td>
<td>2.82</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>TLC</td>
<td>l</td>
<td>0.74</td>
<td>4.34</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>l</td>
<td>2.03</td>
<td>2.28</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>RV/TLC</td>
<td>%</td>
<td>32</td>
<td>53</td>
<td>167</td>
<td></td>
</tr>
<tr>
<td>RAW tot</td>
<td>kPa/l</td>
<td>0.30</td>
<td>0.51</td>
<td>169</td>
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</tr>
<tr>
<td>sGAW tot</td>
<td>l/kPa/s</td>
<td>1.40</td>
<td>0.70</td>
<td>50</td>
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CO-Diffusion:

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<th>Parameter</th>
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<th>Pred.</th>
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</thead>
<tbody>
<tr>
<td>HB</td>
<td>g/dl</td>
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</tbody>
</table>
Case # 2
10*TBB
20*TBB
+ PREDNISONE

NON NECROTIZING GRANULOMATOUS DISEASE.
לאחר סטרוידים

לאחר סטרוידים
לאחר סטריוידים

לאחר סטריוידים
• 1,975 patients with sarcoidosis
• 11 patients with an additional histologically proved silicosis
• 4 further patients with a silicosis found out by X-rays
• 57 other patients of this group - professional exposure to quartz dust.

• Coincidence of both diseases without regards of causal and pathogenetic connections.
• Hübener E Kühne W Scharkoff T 186-93:(2)166;1986 Zeitschrift für Erkrankungen der Atmungsorgane
Association between exposure to crystalline silica and risk of sarcoidosis

Vilhjalmur Rafnsson, Olafur Ingimarsson, Ingimar Hjalmarsson, Holmfridur Gunnarsdottir

Results—Eight cases of sarcoidosis were found, six of which were in the exposed group. Of the 70 referents, 13 were exposed. The odds ratio (95% confidence interval) was 13.2 (2.0 to 140.9).

Conclusion—The odds ratios were high and there were some indications of a dose-response relation which will hopefully encourage further studies. To our knowledge this is the first study to indicate a relation between sarcoidosis and exposure to the crystalline silica, cristobalite. (Occup Environ Med 1998;55:657–660)
Quartz exposures and severe silicosis: a role for the hilar nodes

Anthony Seaton, John W Cherrie

In 1989 we investigated an outbreak of silicosis among eight stonemasons working with sandstone on a Scottish mediaeval cathedral. Two had died of acute silicosis and three others had radiographic changes of classic silicosis; one had early massive fibrosis. A sixth was found to have bilateral hilar lymphadenopathy, ascribed at the time to probable sarcoidosis. The outcome of the man with hilar adenopathy and estimates of the quartz exposures that led to the disease in two of these men are reported.
TruCut\textsuperscript{R} needle biopsy in asbestosis and silicosis: correlation of histological changes with radiographic changes and pulmonary function in 41 patients

P. Tukiainen\textsuperscript{1}, E. Taskinen, O. Korhola\textsuperscript{2}, and M. Valle\textsuperscript{2}

From the \textsuperscript{1}Department of Pulmonary Diseases and \textsuperscript{2}Department of Diagnostic Radiology, University Central Hospital, Aurora Hospital and the Institute of Occupational Health, Helsinki

Sixteen had been exposed to asbestos, 13 to silica and 12 to mixed dust containing quartz, coal, iron, asbestos and talc. All patients in the asbestos group and most in the other two groups had a reduced transfer factor. Most patients in the

Most histological alterations in confirmed or probable pneumoconiosis resembled those seen in many other interstitial lung diseases (Table 4). The interstitial changes in most instances were mild. When viewed by itself, the granulomatous reaction present in seven patients was difficult to distinguish from that seen in sarcoidosis and other granulomatous inflammatory diseases. Granuloma was defined according to Warren (1976) as a focal chronic inflammatory reaction characterised by accumulation and proliferation of leucocytes, principally of the mononuclear type. One such case is illustrated
סקאווירוזים-סיליקוזים

Caseating Non-Granulomas
• קשקשים ריאתים
• קשקשים שלא ס꺼פים שיעול קזר נשימה
• סימפטומים לא ספציפיים שישולק כזכרה נשימה

בכל ת Spells mediosת לישים שיש להשליך קודם כל
على סיליקוזים ובאמ היסטולוגיה מריאה
granulomas

גרנולומת

• גרנולומת
• קשקשים ריאתים
• סימפטומים לא ספציפיים שישולק כזכרה נשימה

בכל ת Spells mediosת לישים שיש להשליך קודם כל
على סיליקוזים ובאמ היסטולוגיה מריאה
granulomas
CASE #3

- 27 Make
- Non smoker
- 10 years exposure to CaesarStone ®
- 2002 – Cough
- 2006 - Bronchoscopy for Lymphadenopathy ➔ not diagnostic
- Positive PPD ➔ LATENT TB ➔ Isoniazid (9months) – clinical improvement
- Cough ➔ Steroid treatment
- Shortness of breath – 200m
- Hemoptysis
RABIN MEDICAL CENTER
Beilinson Hospital Pulmonary Institute
Tel: 03-9377213 Fax: 03-9424091
Chief: Prof. M. Kramer

Family name: [Redacted] Height: 172 cm
First name: [Redacted] Weight: 54 kg
ID: 000091411071 Sex: [Redacted]
Birthdate: 03.12.1983 BMD: [Redacted]
Physician: [Redacted] Date: 10.02.2010 / 11:1
Technician: [Redacted] Comment: [Redacted]

Flow / CO-Diffusion / Bodypehathysmography

Flow-Volume:

<table>
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<td>27</td>
</tr>
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<td>27</td>
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<td>9.59</td>
<td>5.18</td>
<td>97</td>
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<td>MEF25</td>
<td>l/s</td>
<td>8.17</td>
<td>2.01</td>
<td>25</td>
</tr>
<tr>
<td>MEF50</td>
<td>l/s</td>
<td>5.36</td>
<td>1.00</td>
<td>20</td>
</tr>
<tr>
<td>MEF75</td>
<td>l/s</td>
<td>2.47</td>
<td>0.40</td>
<td>14</td>
</tr>
<tr>
<td>FVCin</td>
<td>l</td>
<td>5.11</td>
<td>0.74</td>
<td>14</td>
</tr>
</tbody>
</table>

Bodypehathysmography:

VC 1 l 5.11 1.18 23
IC 1 l 3.49 0.47 14
ERV 1 l 1.57 0.71 49
TGV 1 l 5.17 2.10 56
TLC 1 l 6.66 2.57 39
RV 1 l 1.60 1.39 87
RV/TLC % 24 54 225
RAWtot kPa/(l/s) 0.30 0.41 138
SGAWtot l/2kPa/s 1.50 1.15 77

CO Diffusion:

HB g/dl 14.6
DLco(Hb) ml/min/mmHg 34.00 8.85 25
Kco(Hb) ml/min/mmHg 5.10 3.79 74

Comment: sat = 98%, 6 min w = 568m, sat after 92%
CASE #3
CASE #3
TREATMENT
CASE #3 - *2
CASE 3 - *20
CASE #3

LEFT LUNG (EXPLANTED) SPECIMEN:
- MULTIPLE FIBROTIC NODULES WITH AREAS OF CONFLUENT FIBROSIS AND SIGNS OF END STAGE INTERSTITIAL FIBROSIS (HONEYCOMB LUNG).
  - IN ADDITION, EXTENSIVE FEATURES OF PULMONARY ALVEOLAR PROTEINOSIS, CHOLESTEROL CLEFTS, INTERSTITIAL INFLAMMATORY INFILTRATES.
- PLEURA SHOWING MODERATE TO SEVERE FIBROUS THICKENING AND INFLAMMATORY INFILTRATES.

MORPHOLOGICAL FINDINGS COMPATIBLE WITH SILICOSIS.
-after the transplantation of the left lung.
CASE REPORT

Pulmonary alveolar proteinosis induced by silica dust?

Riitta Sauni¹, R. Järvenpää², E. Ivonen³, S. Nevalainen⁴ and J. Uitti¹

Abstract Pulmonary alveolar proteinosis (PAP) is a rare disease, with several actiologies. This study reports the first Finnish case of PAP with possible induction by silica dust. A 38-year-old male patient had a documented history of heavy exposure to silica dust over a long period, although he himself considered the exposure to be low. The patient’s cumulative exposure to silica dust was ~10 mg m⁻³ years according to the workplace measurements. The patient developed classical symptoms and signs of PAP that closely mimicked those of acute silicosis, but he did not have any signs of classic silicosis. We conclude that significant chronic exposure to silica favours the diagnosis of PAP rather than acute silicosis in this case. PAP should be taken into account when patients exposed to silica dust complain of respiratory symptoms. A patient’s assessment of his/her exposure to silica may not always be reliable.

Key words Acute silicosis; exposure; lung disease; occupational disease; pulmonary alveolar proteinosis; silica.
State of the Art

Pulmonary Alveolar Proteinosis
Progress in the First 44 Years

John F. Seymour and Jeffrey J. Presnell

Ludwig Institute for Cancer Research, Melbourne Tumour Biology Branch, and the Intensive Care Unit, The Royal Melbourne Hospital, Parkville, Australia

view being that of enhanced surfactant secretion in response to an unknown inhaled irritant. Recognizing some histologic similarities with PAP, acute inhalation of silica (97, 98) and

DOI: 10.1164/rccm.2109105
Silicoproteinosis: High-Resolution CT Findings in 13 Patients

Edson Marchiori¹
Carolina Althoff Souza²
Tatiana Gontijo Barbassa¹
Nante I. Escurissaro³
Emerson L. Gasparetto¹
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The histologic findings of silicoproteinosis resemble those of primary alveolar proteinosis, that is, PAS-positive lipoproteinaceous material filling the air spaces [2, 3, 7]. Unlike classic silicosis, silicoproteinosis manifests as minimal collagen deposition and fibrosis. Silicotic nodules, the hallmark of classic silicosis, when present, are smaller than in classic silicosis and may or may not contain weakly birefringent silicate crystals [2, 3]. The radiographic manifestation of silicoproteinosis, like that of primary alveolar proteinosis, is bilateral parenchymal consolidation.
Inorganic Particulates associated with Pulmonary alveolar proteinosis: SEM and X-RAY microanalysis resulates


- **24 cases of pulmonary alveolar proteinosis** (PAP) were studied by light microscopy (LM) and scanning electron microscopy (SEM) to test the hypothesis that PAP was related to silica exposure.

- Increased numbers of birefringent particles (vs. controls) were found in 78% of PAP cases.

- Available environmental history correlated well with particulate analysis results, e.g., silica in a sandblaster, metal fumes in a welder, and cement particles in a cement finisher. Particulates with unique composition were also found in cases with unavailable histories, e.g. metal fumes suggestive of welding or soldering exposure, silicates suggestive of fine particle exposure (greater than 50% of particles less than 1 micron). Only 1 case (the sandblaster) showed greater than 50% of the particles to be silica. Of the 5 infants with PAP, 3 showed the major particulate to be talc, and 1 had evidence of toxic cadmium selenide fume exposure.

- These results are consistent with the hypothesis that PAP, at least in the majority of cases, is associated with exposure to small inorganic particulates of several types.
SHORT REPORT

Survival following lung transplantation for silicosis and other occupational lung diseases

J. P. Singer\textsuperscript{1,2,*}, H. Chen\textsuperscript{1,2}, T. Phelan\textsuperscript{2}, J. Kukreja\textsuperscript{3}, J. A. Golden\textsuperscript{1} and P. D. Blanc\textsuperscript{2,4}
• קיימת מגפת סיליקוזיס בישראל בעובדי שיש ששיי עכם.
אבן קיסר והיה קצלני!

• ההתקאות הקליניות של התמונה להטיות ולהאונות
התמוונה של סרקואידוזיס, פרוטאינוזיס ואפידילומומה
לymoonמה

• יש חשוד בסיליקוזיס בכל חולה עם אנמנזה של

• עבדה בשיש מסוף אבן קיסר.

 negócio משקנוני
Pneumonoultramicroscopicsilicovolcanoconiosis

the longest English word and is the longest word ever to appear in an English language dictionary
Non omne quod nitet aurum est

לָא כָּל ַהָּפִּניָּן ַזָּהֵב ַהוּא