

Artificial Intelligence in Medicine

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Definition

- in 1984, Clancey and Shortliffe provided the following definition:
'Medical artificial intelligence is primarily concerned with the construction of AI programs that perform diagnosis and make therapy recommendations. Unlike medical applications based on other programming methods, such as purely statistical and probabilistic methods, medical AI programs are based on symbolic models of disease entities and their relationship to patient factors and clinical manifestations.'

Definition

- Artificial Intelligence (AI): Application of computers to areas normally regarded as requiring human intelligence. Also, devices and applications that exhibit human intelligence and behavior

Definistion

- Expert system: a computer system that emulates the decision-making ability of a human expert.

History

Work originated out of a number of campuses, including MIT-Tufts, Pittsburgh, Stanford and Rutgers (e.g. Szolovits, 1982; Clancey and Shortliffe, 1984; Miller, 1988).

Role of AIM

- An AI system could be running within an electronic medical record system, for example, and alert a clinician when it detects a contraindication to a planned treatment.
- It could also alert the clinician when it detected patterns in clinical data that suggested significant changes in a patient's condition.

Applications of AI

- ***Generating alerts and reminders.*** In so-called real-time situations, an expert system attached to a monitor can warn of changes in a patient's condition. In less acute circumstances, it might scan laboratory test results or drug orders and send reminders or warnings through an e-mail system.
- ***Diagnostic assistance.*** When a patient's case is complex, rare or the person making the diagnosis is simply inexperienced, an expert system can help come up with likely diagnoses based on patient data.
- ***Therapy critiquing and planning.*** Systems can either look for inconsistencies, errors and omissions in an existing treatment plan, or can be used to formulate a treatment based upon a patient's specific condition and accepted treatment guidelines.

Applications of AI

- ***Agents for information retrieval.*** Software 'agents' can be sent to search for and retrieve information, for example on the Internet, that is considered relevant to a particular problem. The agent contains knowledge about its user's preferences and needs, and may also need to have medical knowledge to be able to assess the importance and utility of what it finds.
- ***Image recognition and interpretation.*** Many medical images can now be automatically interpreted, from plane X-rays through to more complex images like angiograms, CT and MRI scans. This is of value in mass-screenings, for example, when the system can flag potentially abnormal images for detailed human attention.

Table 4
Comparison of Artificial Intelligence Techniques

Type	Knowledge Representation	Unsupervised (learns from data without teacher)	Robust (can handle unforeseen data)	Adaptive (can learn new data)	Rational (can explain reasoning)
Rule-based reasoning	Production (if-then) rules	No	No	No	YES
Artificial neural network	Graphic	YES	No	YES	No
Hypertext	Textual documents with links	No	No	No	No
Bayesian network	Graphic	No	No	No	YES
CBR	Cases and indexes	No	YES	YES	YES

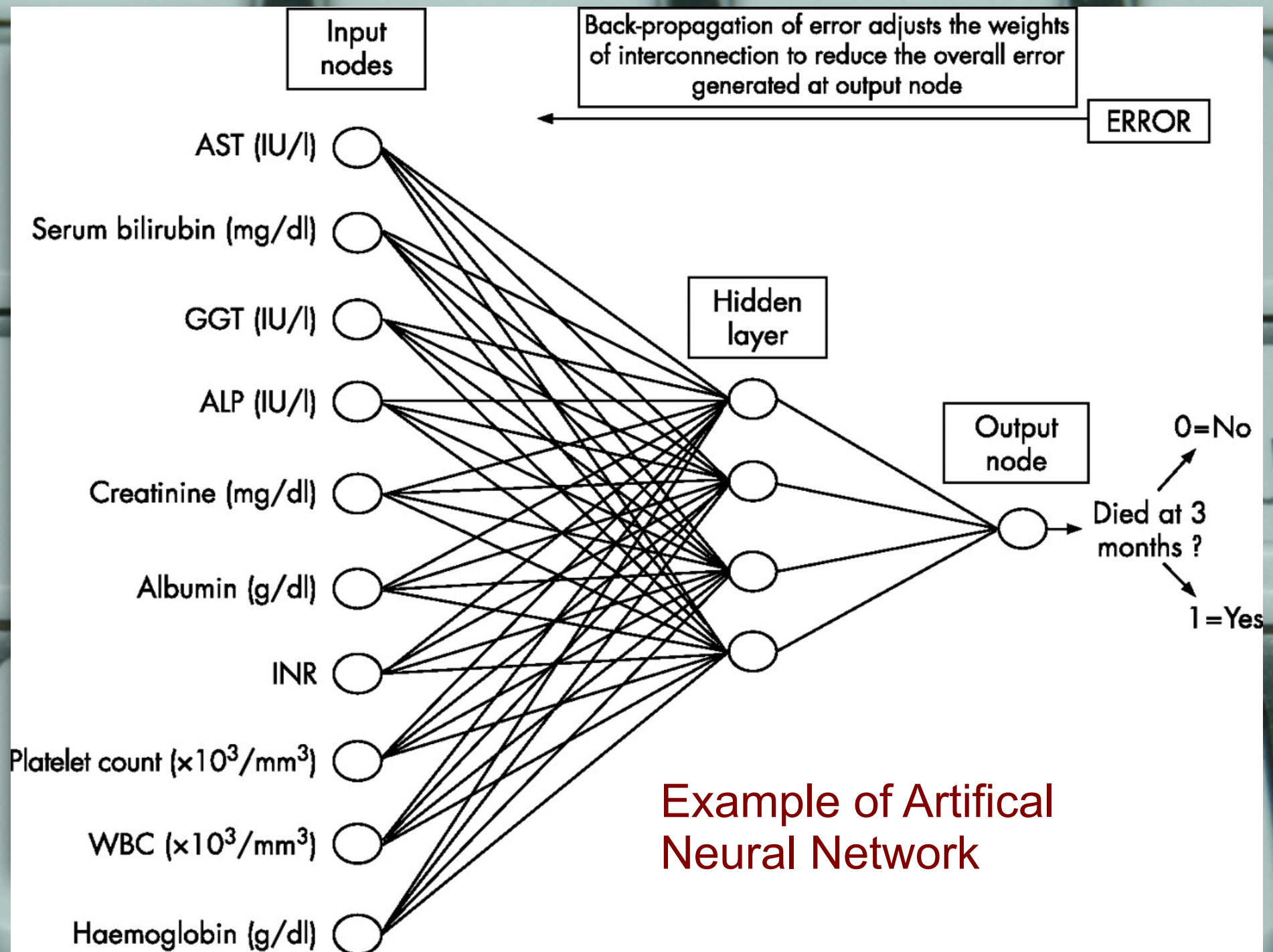


Table 5**Recipe for Success: Building a Successful Decision Support System**

Ingredient	Instructions for Preparation
Availability	Make the system readily available at workstations in clinics, inpatient wards, intensive care units, laboratories, and radiology departments, preferably by means of a central computer system or network. (Many excellent programs are on isolated computers in a laboratory or office and are infrequently used)
Ease of use	Make the user interface uniform, intuitive, and fast. Physicians have many demands on their time and will not tolerate a system that requires a large amount of data entry or that responds after long pauses
Integration	Embed the system within the physician's usual clinical functions. A system that helps interpret mammograms should be part of the reporting process
Collaboration	Assist and support the physician's decision-making process; do not usurp it. Let the computer present information; let the physician integrate it into a decision
Accuracy and consistency	Test the system rigorously. Validate the system's knowledge and evaluate its performance and acceptability
Awareness of limits	As with people, problems can occur at the boundary between knowledge and ignorance. The system should know the limits of its knowledge and inform the physician accordingly
Good medicine	Solve important problems. The system should demonstrably and significantly improve the quality and cost-effectiveness of medical care, and ultimately improve the health of patients

Why AI is not commonly used in practice ?

- Lack of EMR (Electronic Medical Record)
- Poor user interface
- Change needs time
- Technophobia or computer illiteracy of healthcare workers

Adult, Young (18 to 40 yrs) ▼

Male ▼ 1-4 weeks ▼

Finding Lookup

☐ No

weight

birth weight high
birth weight low
low weight
weight fluctuation
weight gain
weight loss
weight loss, severe
weight loss

This page presents DXplain in Case Analysis mode and allows entering a case.

You will describe the patient by entering clinical findings. DXplain provides a wide variety of findings, including demographic, history, physical, laboratory and imaging results.

Though optional, the authors suggest you enter patient age, gender and duration of symptoms using the drop-down menus in the upper left hand portion of the page.

Use the blank "Finding Lookup" box to enter findings one at a time. After you type 2 or more characters, DXplain will display findings that contain your entry. Click on the term that best matches the finding you wish to enter. Where applicable, DXplain will display a list of more specific terms for the finding you selected and you may pick one of these if you so wish.

To indicate that a finding is ABSENT, rather than present, click the "No" checkbox *before* selecting a finding from the match list.

For all cases presented to DXplain, we recommend that you provide the patient's age and gender and a rough estimate of the duration of the disease.

Clinical manifestations are entered by typing the first few characters of a finding name into the Finding Lookup box. As you type each character, the system displays those terms that contain the characters you typed. Once you see the choice you want, click on it to select it.

To indicate the absence of a finding, such as "No Fever", Click the "No" checkbox prior to selecting your finding.

Adult, Young (18 to 40 yrs)
 Male > 4 weeks

[New Case](#) | [Save Case](#) | [Retrieve Case](#)

[Disease Comparison](#)

[DXplain Algorithm](#)

Finding Lookup

☐ No

- weight loss
- weight loss, severe
- weight loss, slight

Case Findings

- ☒ weight loss
- ☒ Mexican
- ☒ hip pain

- ☒ Remove finding from case findings list
- ☒ Change findings "Present/Absent"
- ☒ Focus ON/OFF

OPTIONAL - Are these findings present?

<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk	glycosuria	<input type="button" value="v"/>
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk	insulin increase	<input type="button" value="v"/>
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk	ketoacidosis, diabetic	<input type="button" value="v"/>
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk	polyneuropathy	<input type="button" value="v"/>

Common Diseases

- Diabetes mellitus type 2
- Diabetes mellitus type 1
- Adverse effects of medication
- Fluorine and compounds poisoning, chronic
- Non-alcoholic fatty liver disease
- Osteoporosis
- Tuberculosis, pulmonary
- Endogenous depression
- Neuropathy, diabetic
- Emphysema, pulmonary

Rare Diseases

- Amebiasis
- Malaria
- Trichloroethylene poisoning
- Blastomycosis, North American
- Chagas disease
- Coccidioidomycosis
- Aseptic necrosis of hip
- Larva migrans, visceral
- Leishmaniasis, American cutaneous
- Pinta

++ sufficient evidence to strongly support this DX
 + sufficient evidence to support this DX
 sufficient evidence to suggest this DX
 -- minimal evidence to suggest this DX

As findings are selected, they appear in the Case Findings Window.

DXplain displays lists of Common and Rare diseases that are associated with some or all of the case findings. These lists are dynamically refreshed each time a new case finding is entered.

Adult, Young (18 to 40 yrs)
 Male > 4 weeks

[New Case](#) | [Save Case](#) | [Retrieve Case](#)

[Disease Comparison](#)

[DXplain Algorithm](#)

Finding Lookup

☐ No

Case Findings

☒ ☒ ☒ anorexia
☒ ☒ ☒ movement pain
☒ ☒ ☒ intermittent
☒ ☒ ☒ back pain, lower
☒ ☒ ☒ weight loss
☒ ☒ ☒ Mexican
☒ ☒ ☒ hip pain

☒ Remove finding from case findings list
☒ Change findings "Present/Absent"
☒ Focus ON/OFF

Submit

OPTIONAL - Are these findings present?

☐ Y ☐ N ☐ Unk

straight leg raising test positive

☐ Y ☐ N ☐ Unk

diarrhea, bloody

☐ Y ☐ N ☐ Unk

stool blood, gross

☐ Y ☐ N ☐ Unk

vocal cord paralysis

Common Diseases

Muscular low back pain
 -- Lung, carcinoma, metastatic
 -- Intervertebral disc rupture, lumbar
 -- Colitis, ulcerative
 -- Gastric ulcer
 -- Endogenous depression
 -- Adverse effects of medication
 -- Reactive depression
 -- Rotator cuff tear
 -- Bursitis, trochanteric

Rare Diseases

-- Amebiasis
 -- Reiter syndrome
 -- Spondylitis, ankylosing
 -- Malaria
 -- Brucellosis
 -- Mediterranean fever, familial
 -- Lumbar spinal stenosis
 -- C1 esterase inhibitor deficiency

++ sufficient evidence to strongly support this DX
 + sufficient evidence to support this DX
 sufficient evidence to suggest this DX
 -- minimal evidence to suggest this DX

Based on the initial findings entered, DXplain lists a broad differential including infection and cancer. The "--" mark indicates diagnoses that are only minimally supported.

Finding -- vocal cord paralysis

Very strongly supports LUNG, CARCINOMA, METASTATIC

Close Window

Note that "vocal cord paralysis" is important in metastatic lung CA.

This ability of DXplain to explain its disease selections is a significant feature.

DXplain prompts the user for clinical findings that may help to distinguish among possible diagnoses. The User can choose to indicate that one of the suggested clinical manifestations is present (Y), or is known to be absent (N), or that there is no information about the presence of a particular finding (Unk).

By clicking on the question mark, the user can query the system as to how the presence or absence of a particular presented finding ('vocal cord paralysis' in this example) will affect DXplain's differential. This is shown in the yellow box at right.

Adult, Young (18 to 40 yrs) ▾

Male ▾ > 4 weeks ▾

Finding Lookup

☐ No 🔍

The current finding list is too long to fit on this screen; in the actual DXplain program, a scrolling window reveals the entire list.

[New Case](#) | [Save Case](#) | [Retrieve Case](#)

Case Findings

- ☒ ☐ sheep exposure
- ☒ ☐ fever
- ☒ ☐ back tenderness, lower
- ☒ ☐ spleen palpable
- ☒ ☐ hepatomegaly
- ☒ ☐ anorexia
- ☒ ☐ movement pain
- ☒ ☐ intermittent
- ☒ ☐ back pain, lower
- ☒ ☐ weight loss
- ☒ ☐ Mexican

- ☒ Remove finding from case findings list
- ☒ Change findings "Present/Absent"
- ☒ Focus ON/OFF

Submit ▶

OPTIONAL - Are these findings present? ?

- | | | |
|---|--------------|---|
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | hepatitis | ? |
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | fatty liver | ? |
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | rose spot(s) | ? |
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | lymphoma | ? |

After additional clinical findings have been entered, a revised list shows that several diagnoses are now supported.

[Disease Comparison](#)[DXplain Algorithm](#)

Common Diseases

- + **Hodgkins disease**
- + Non-alcoholic fatty liver disease
- + Lymphocytic lymphoma
- + Hepatitis, acute type B
- Endocarditis, bacterial, subacute
- Infectious mononucleosis
- Sarcoidosis
- Hepatitis, acute type A
- Hepatitis, alcoholic
- Hepatitis, acute type E

Rare Diseases

- + Brucellosis
- + Paratyphoid
- Arthritis, rheumatoid, juvenile (Still's disease)
- Hepatocarcinoma
- Leukemia, myelocytic, chronic
- Histiocytosis, malignant
- Typhoid fever
- Endocarditis, bacterial, right-sided
- Idiopathic granulomatous hepatitis
- Reticuloendotheliosis, leukemic

- ++ sufficient evidence to strongly support this DX
- + sufficient evidence to support this DX
- sufficient evidence to suggest this DX
- minimal evidence to suggest this DX

When the user clicks on 'Hodgkins disease,' this will bring up DXplain's Evidence for Hodgkins disease, as shown on the next screen.

[Return to Case Analysis page](#)[Disease Description](#) | [PubMed Search](#) | [Google Search](#)

Evidence of "HODGKINS DISEASE" (COMMON)

The following findings strongly support this disease:

[hepatomegaly](#)

The following findings support this disease:

[weight loss](#)[anorexia](#)[spleen palpable](#)[fever](#)

The following findings are not part of DXplain's description of this disease:

[back tenderness, lower](#)**ADD selected finding(s) to Case**

OPTIONAL: Any of the findings below may be added to the case by clicking the 'ADD selected finding(s) to Case' button next to the finding(s) and then clicking the 'ADD selected finding(s) to Case' button.

The following clinical manifestations (if present) would also support this disease:

- ☐ [alcohol intolerance](#)
- ☐ [dermatitis, exfoliative](#)
- ☐ [epitrochlear lymph node enlargement](#)
- ☐ [inguinal lymph node enlargement](#)
- ☐ [liver mass](#)
- ☐ [vena cava obstruction, superior](#)
- ☐ [vena cava obstruction, inferior](#)
- ☐ [femoral lymph node enlargement](#)
- ☐ [popliteal lymph node enlargement](#)
- ☐ [Pemberton sign positive](#)
- ☐ [fever, Pel-Ebstein](#)
- ☐ [ascites, chylous](#)
- ☐ [axillary lymph node enlargement](#)
- ☐ [erythema multiforme](#)
- ☐ [erythema nodosum](#)
- ☐ [hepatosplenomegaly](#)
- ☐ [mesenteric lymph node enlargement](#)

The user can click on "Disease Description" to toggle between this "Evidence" page, and a textbook-like description of disease findings, as shown on the next screen.

Listed first are the findings the user has entered which support "Hodgkins Disease".

Listed below are relevant findings of the disease which have not been entered nor noted as absent.

To add any of these findings to the case, the user can click the check box(es) and then the "ADD selected finding(s) to Case" button.

[Return to Case Analysis page](#)[Evidence of Disease](#) | [PubMed Search](#) | [Google Search](#)

HODGKINS DISEASE

DEFINITION

A malignant disease characterized by progressive enlargement of the lymph nodes, spleen, and general lymphoid tissue, and the presence of large, usually multinucleate, cells (REED-STERNBURG CELLS) of unknown origin. MeSH, NLM 1999

OTHER NAMES

Lymphogranulomatosis, malignant; Lymphadenoma, multiple; Sternberg disease.

ETIOLOGY

Unknown; most frequent of malignant lymphoma group of diseases; age incidence showing peaks at 25 and 70.

SYMPTOMS

USUALLY: chronic (> 4 weeks).

SOMETIMES: bone pain; night sweats; sweating increase; weight loss; weight loss, slight; insidious onset of symptoms; urinary tract obstruction; paraplegia; anorexia; dysphagia; constipation; diarrhea; steatorrhea; abdominal pain; arthralgia; back pain; kidney disease; renal failure; neck pain; headache; malaise; motor disorder; paresthesia; sensory disorder; cough; dyspnea; pruritus.

RARELY: alcohol intolerance; fecal incontinence; incontinence; urinary bladder incontinence; extremity paralysis, lower; extremity muscle weakness, lower; muscular weakness; stridor; wheezing.

ADDITIONAL NOTES: Initial manifestations possibly related to ordinary respiratory infection, other infection about head, neck; pain, obstructive phenomena in areas affected; chills.

MAKE DIAGNOSIS LESS LIKELY: lymph node pain, regional; very brief (< 6 hours).

REFERENCES | [PubMed Search](#)

- [1. Hodgkin's lymphoma in adults--clinical features. J Ky Med Assoc. 2005 Jan;103\(1\):15-7.](#)
- [2. Management of Hodgkin lymphoma. Mayo Clin Proc. 2006 Mar;81\(3\):419-26.](#)
- [3. Hodgkin Lymphoma in adolescents. Cancer Treat Rev. 2005 Aug;31\(5\):339-60. Epub 2005 Jun 13.](#)
- [4. Clinical perspectives in lymphoma. Intern Med J. 2007 Jul;37\(7\):478-84.](#)

The Disease Description page lists the findings found in a particular disease in order of the frequency with which they occur.

The user can click on "Evidence of Disease" to toggle back to that page.

DXplain provides links to selected Medline references

[Return to Case Analysis page](#)[Disease Description](#) | [PubMed Search](#) | [Google Search](#)

Evidence of "HODGKINS DISEASE" (COMMON)

The following findings strongly support this disease:

[hepatomegaly](#)

The following findings support this disease:

[weight loss](#)[anorexia](#)[spleen palpable](#)[fever](#)

The following findings are not part of DXplain's description of this disease:

[back tenderness, lower](#)**ADD selected finding(s) to Case**

OPTIONAL: Any of the findings below may be added to the current case by clicking the box(es) next to the finding(s) and then clicking the 'ADD selected finding(s) to Case' button.

The following clinical manifestations (if present) would also support this disease:

- ☐ [alcohol intolerance](#)
- ☐ [dermatitis, exfoliative](#)
- ☐ [epitrochlear lymph node enlargement](#)
- ☐ [inguinal lymph node enlargement](#)
- ☐ [liver mass](#)
- ☐ [vena cava obstruction, superior](#)
- ☐ [vena cava obstruction, inferior](#)
- ☐ [femoral lymph node enlargement](#)
- ☐ [popliteal lymph node enlargement](#)
- ☐ [Pemberton sign positive](#)
- ☐ [fever, Pel-Ebstein](#)
- ☐ [ascites, chylous](#)
- ☐ [axillary lymph node enlargement](#)
- ☐ [erythema multiforme](#)
- ☐ [erythema nodosum](#)
- ☐ [hepatosplenomegaly](#)
- ☐ [mesenteric lymph node enlargement](#)

The user can click on any finding to see a list of diseases associated with that finding. In this example, the user clicks on "Superior Vena Cava Obstruction".

[Return to Case Analysis page](#)[Google Search](#)

"VENA CAVA OBSTRUCTION, SUPERIOR" is a very important finding which should be explained by at least one disease in the differential diagnosis.

Additional Information: Obstruction of the superior vena cava is most commonly caused by neoplasm, particularly lung cancer. It can also be caused by thrombosis, aneurysm, or external compression. It causes suffusion and/or cyanosis of the face, neck, and upper arms. If slow in development, collateral circulation can lessen some of the manifestations. For an interesting perspective, see: Plekker D et al 'Clinical and radiologic grading of SVC obstruction' Respiration, 2007.

Note that the position of each disease in a group is arbitrary and does not indicate the degree of support.

Some findings have additional findings

[New Case](#) | [Save Case](#) | [Retrieve Case](#)

[Disease Comparison](#)

[DXplain Algorithm](#)

Case Findings

- ☒ ☒ ☒ butcher
- ☒ ☒ ☒ sheep exposure
- ☒ ☒ ☒ fever
- ☒ ☒ ☒ back tenderness, lower
- ☒ ☒ ☒ spleen palpable
- ☒ ☒ ☒ hepatomegaly
- ☒ ☒ ☒ anorexia
- ☒ ☒ ☒ movement pain
- ☒ ☒ ☒ intermittent
- ☒ ☒ ☒ back pain, lower

- ☒ Remove finding from case findings list
- ☒ Change findings "Present/Absent"
- ☒ Focus ON/OFF

Submit

OPTIONAL - Are these findings present?

- | | | |
|---|--------------|--|
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | hepatitis | <input style="border: none; background: none;" type="button" value="?"/> |
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | fatty liver | <input style="border: none; background: none;" type="button" value="?"/> |
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | rose spot(s) | <input style="border: none; background: none;" type="button" value="?"/> |
| <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> Unk | lymphoma | <input style="border: none; background: none;" type="button" value="?"/> |

Common Diseases

- + Hodgkins disease
- + Non-alcoholic fatty liver disease
- + Lymphocytic lymphoma
- + Hepatitis, acute type B
- Endocarditis, bacterial, subacute
- Infectious mononucleosis
- Sarcoidosis
- Hepatitis, acute type A
- Hepatitis, alcoholic
- Hepatitis, acute type E

Rare Diseases

- + **Brucellosis**
- + Paratyphoid
- Arthritis, rheumatoid, juvenile (Still's disease)
- Hepatocarcinoma
- Leukemia, myelocytic, chronic
- Histiocytosis, malignant
- Typhoid fever
- Endocarditis, bacterial, right-sided
- Idiopathic granulomatous hepatitis
- Reticuloendotheliosis, leukemic

- ++ sufficient evidence to strongly support this DX
- + sufficient evidence to support this DX
- sufficient evidence to suggest this DX
- minimal evidence to suggest this DX

Returning to the Case Analysis, the user can click on 'Brucellosis' (the case diagnosis of this New England Journal CPC). This will result in the display of DXplain's Evidence for this diagnosis, as well as the option to view other resources to obtain reference information, as shown on the next slide.

[Return to Case Analysis page](#)
[Disease Description](#) | [PubMed Search](#) | [Google Search](#)

Evidence of "BRUCELLOSIS" (RARE)

The following findings strongly support this disease:

[spleen palpable](#)
[a type of back tenderness](#)
[sheep exposure](#)

The following findings support this disease:

[weight loss](#)
[intermittent](#)
[anorexia](#)
[hepatomegaly](#)
[fever](#)
[butcher](#)

This page shows the evidence for the disease selected (Brucellosis). A runtime search of PubMed offers the most recent abstracts available. The Google Search link allows the user to see content from a special selection of authoritative medical websites.

One of the more important features of DXplain is the ability for users to send comments, questions and criticisms directly to the developers via the Feedback link. The developers will try to respond promptly.

ADD selected finding(s) to Case

OPTIONAL: Any of the findings below may be added to the current case by clicking then clicking the 'ADD selected finding(s) to Case' button.

The following clinical manifestations (if present) would also support this disease:

- ☐ [orchitis](#)
- ☐ [Middle East](#)
- ☐ [spleen tenderness](#)
- ☐ [testicular pain](#)
- ☐ [testicular enlargement](#)
- ☐ [perspiration malodorous](#)
- ☐ [biological warfare](#)
- ☐ [raw milk ingestion](#)

Examples of the PubMed and Google searches are shown on the next two slides.

The following lab data (if present) would be useful in establishing the presence of the disease:

- ☐ [granulomas on biopsy](#)

The 'Help' feature, available from each screen, provides page-specific help for all features found on that page. A summary of DXplain's main functions and features can also be retrieved using 'Help.'

Search PubMed for (((((((Brucellosis/diagnosis[MeSH Terms] AND has Go Clear Save Search

Limits Preview/Index History Clipboard Details

Display Summary Show 20 Sort by Send to

All: 51 Review: 51

Items 1 - 20 of 51

1: [McGiven JA, Stack JA, Perrett LL, Tucker JD, Brew SD, Stubberfield E, MacMillan AP.](#)

Harmonisation of European tests for serological diagnosis of Brucella infection in bovine. *Rev Sci Tech.* 2006 Dec;25(3):1039-53. Review. PMID: 17361769 [PubMed - indexed for MEDLINE]

2: [Dhand A, Ross JJ.](#)

Implantable cardioverter-defibrillator infection due to *Brucella melitensis*: case report and review of brucellosis of cardiac devices. *Clin Infect Dis.* 2007 Feb 15;44(4):e37-9. Epub 2007 Jan 5. Review. PMID: 17243046 [PubMed - indexed for MEDLINE]

3: [Pappas G, Panagopoulou P, Christou L, Akritidis N.](#)

Brucella as a biological weapon. *Cell Mol Life Sci.* 2006 Oct;63(19-20):2229-36. Review. PMID: 16964579 [PubMed - indexed for MEDLINE]

4: [Turgut M, Turgut AT, Kosar U.](#)

Spinal brucellosis: Turkish experience based on 452 cases published during the last century. *Acta Neurochir (Wien).* 2006 Oct;148(10):1033-44; discussion 1044. Epub 2006 Sep 8. Review. PMID: 16944052 [PubMed - indexed for MEDLINE]

5: [Miguel PS, Fernandez G, Vasallo FI, Horta M, Lorenzo JR, Rodriguez I, Ortiz-Rey JA, Anton I.](#)

Neurobrucellosis mimicking cerebral tumor: case report and literature review. *Clin Neurol Neurosurg.* 2006 Jun;108(4):404-6. Review. PMID: 16644407 [PubMed - indexed for MEDLINE]

6: [Smits HL, Kadri SM.](#)

Brucellosis in India: a deceptive infectious disease. *Indian J Med Res.* 2005 Nov;122(5):375-84. Review. PMID: 16456249 [PubMed - indexed for MEDLINE]

7: [Ustun I, Ozcakar L, Arda N, Duranay M, Bayrak E, Duman K, Atabay M, C.](#)

Brucella glomerulonephritis: case report and review of the literature. *South Med J.* 2005 Dec;98(12):1216-7. Review.

After the user selects "PubMed Search," DXplain sends a search strategy to the National Library of Medicine's PubMed that is designed to retrieve relevant clinical articles for the chosen disease. This screen shows the results.

By clicking on the reference link, one can see the complete abstract, a portion of which is shown here.

Brucellosis in India: a deceptive infectious disease.

[Smits HL, Kadri SM.](#)

KIT Biomedical Research, Royal Tropical Institute/Koninklijk Instituut voor de Tropen, A Netherlands. H.Smits@kit.nl

Brucellosis is an important but neglected disease in India. This zoonotic disease, livestock systems and increased demand for dairy products accompanied with changing farming practices has raised the concern for increased spread and intensified transmission to the human population with increased risk of disease. Brucellosis can be treated with a combination of difficult to diagnose and requires laboratory testing for confirmation. Only a few addressed the prevalence and importance of brucellosis as a human disease pr


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Web Results 1 - 10 of about 1,610 from [intelihealth.com](#) for **BRUCELOSIS** OR [site:health.harvard.edu](#) OR [site:mayoclinic.com](#) OR [site:hopkinsmedicine.org](#) OR [site:www.nlm.nih.gov](#)

[Treatment](#) [Tests/diagnosis](#) [For patients](#) [From medical authorities](#)

[Symptoms](#) [Causes/risk factors](#) [For health professionals](#) [Alternative medicine](#)

[Disease Listing, Brucellosis, General Information | CDC Bacterial ...](#)

Factsheet with cause, transmission, prevention, symptoms, and treatment.

www.cdc.gov/ncidod/dbmd/diseaseinfo/brucellosis_g.htm - 36k -

[Cached](#) - [Similar pages](#)

[Brucellosis, disease information, NCID, CDC](#)

Brucellosis: (*Brucella melitensis*, *abortus*, *suis*, and *canis*) ... **Brucellosis** From Public Health Response and Preparedness, CDC ...

www.cdc.gov/ncidod/diseases/submenus/sub_brucellosis.htm - 16k -

[Cached](#) - [Similar pages](#)

[eMedicine - CBRNE - Brucellosis : Article by Gerald E Maloney, Jr, DO](#)

CBRNE - **Brucellosis** - **Brucellosis** is a zoonotic infection transmitted from animals to humans by ingestion of infected food products, direct contact with an ...

www.emedicine.com/emerg/topic883.htm - 98k - [Cached](#) - [Similar pages](#)

[MedlinePlus Medical Encyclopedia: Brucellosis](#)

Factsheet with cause, risk factors, symptoms, complications, diagnosis, treatment, and prevention.

www.nlm.nih.gov/medlineplus/ency/article/000597.htm - 23k -

[Cached](#) - [Similar pages](#)

[eMedicine - Brucellosis : Article by Wafa Al-Nassir, MD](#)

Brucellosis - **Brucellosis** is believed to be an ancient disease that was described more than 2000 years ago by the Romans. Bruce first isolated *Brucella* ...

www.emedicine.com/med/topic248.htm - 113k - [Cached](#) - [Similar pages](#)

[Disease Listing, Brucellosis, Technical Information | CDC ...](#)

In 2001, the National **Brucellosis** Eradication Program reported only 3 newly affected cattle herds, compared to 14 herds identified in 2000. ...

www.cdc.gov/ncidod/dbmd/diseaseinfo/brucellosis_t.htm - 29k -

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[Brucellosis - MayoClinic.com](#)

Brucellosis — Comprehensive overview covers symptoms, transmission and treatment of this serious illness.

www.mayoclinic.com/health/brucellosis/DS00837 - 24k - [Cached](#) - [Similar pages](#)

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