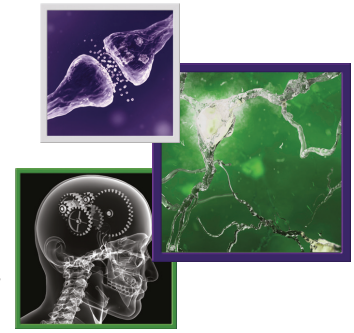
Plain Language Summary of Publication

Neurodegenerative Disease Management

The use of lumbar puncture and safety recommendations in Alzheimer's disease: a plain language summary



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Summary

What is this summary about?

This is a plain language summary of an article published in *Alzheimer's & Dementia*. It looks at a type of test called a **lumbar puncture** (also known as spinal tap) used in people suspected of having **Alzheimer's** disease or some other form of dementia. This summary focuses on how to do a **lumbar puncture** safely.

How to say (double-click on the icon to play sound)…

- **Alzheimer's:** ahlts-hahy-merz
- **Lumbar puncture:** luhm-buh puhngk-chuh
- **Cerebrospinal fluid**: suh-ree-brow-spai-nuhl floo-uhd

Why is this important?

Alzheimer's disease is a progressive condition, which means it gets worse over time. This leads to difficulties with thinking and memory. People with **Alzheimer's** disease show a build up of proteins called amyloid-β and tau in the brain. This is followed by a gradual loss of brain cells and brain function. The changes in the brain are thought to occur years before symptoms appear. **Lumbar puncture** is a medical procedure during which samples of **cerebrospinal fluid** are collected. In **Alzheimer's** disease, it is used to examine **cerebrospinal fluid** biomarkers that can help diagnose disease. **Lumbar puncture** is traditionally considered as a painful and invasive procedure with frequent side effects. However, multiple studies indicate that a **lumbar puncture** can be performed safely. Side effects are typically mild and do not require specialist intervention.

What are the key takeaways?

Despite the low risk of serious complications associated with a **lumbar puncture**, physicians and their patients may be reluctant to recommend or undergo this procedure. Patient education, specialist training, as well as new methods concerning patient safety are important factors to support the widespread use of **lumbar puncture** in **Alzheimer's** disease.

Who is this summary for?

- This summary may be suitable for physicians and practitioners who diagnose and treat **Alzheimer's** disease.
- It may also be relevant to people who experience memory and thinking difficulties associated with **Alzheimer's** disease, as well as their families or caregivers.

Future Medicine part of fsg

Who sponsored this publication?

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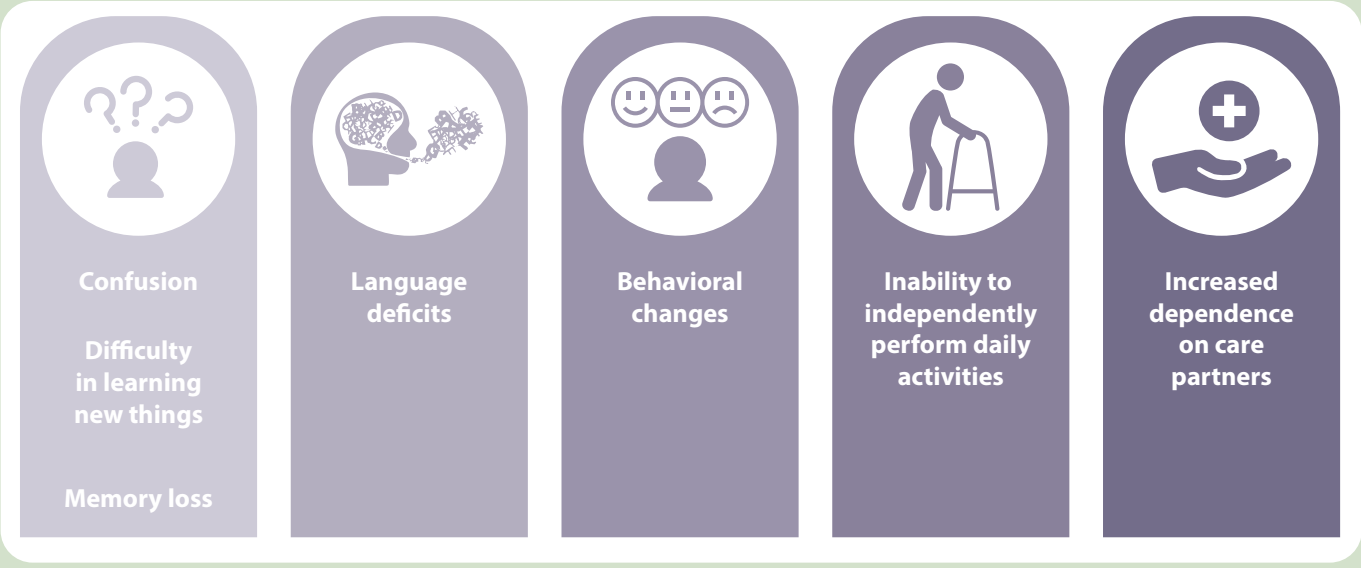
What is the purpose of this summary?

- This summary is a review of the scientific literature published to educate physicians, practitioners, and people about a **lumbar puncture**. It describes the safety profile of performing this procedure in people suspected of having **Alzheimer's** disease or some other form of dementia.
- This summary highlights the importance of education and specialist training to minimize the side effects that may be associated with this procedure.

What is Alzheimer's disease?

- **Alzheimer's** disease is the most common cause of dementia. Around 6 in 10 people in the world suffer from dementia due to **Alzheimer's** disease. The disease mostly affects people over the age of 65 years. **Alzheimer's** disease is increasingly recognized as a process that begins years before symptoms of dementia appear.
- It is a long-term and progressive brain disorder that slowly affects the ability to learn, think, remember, and reason. With advancing disease, people with **Alzheimer's** disease are no longer able to independently perform everyday activities. This negatively affects their overall quality of life.

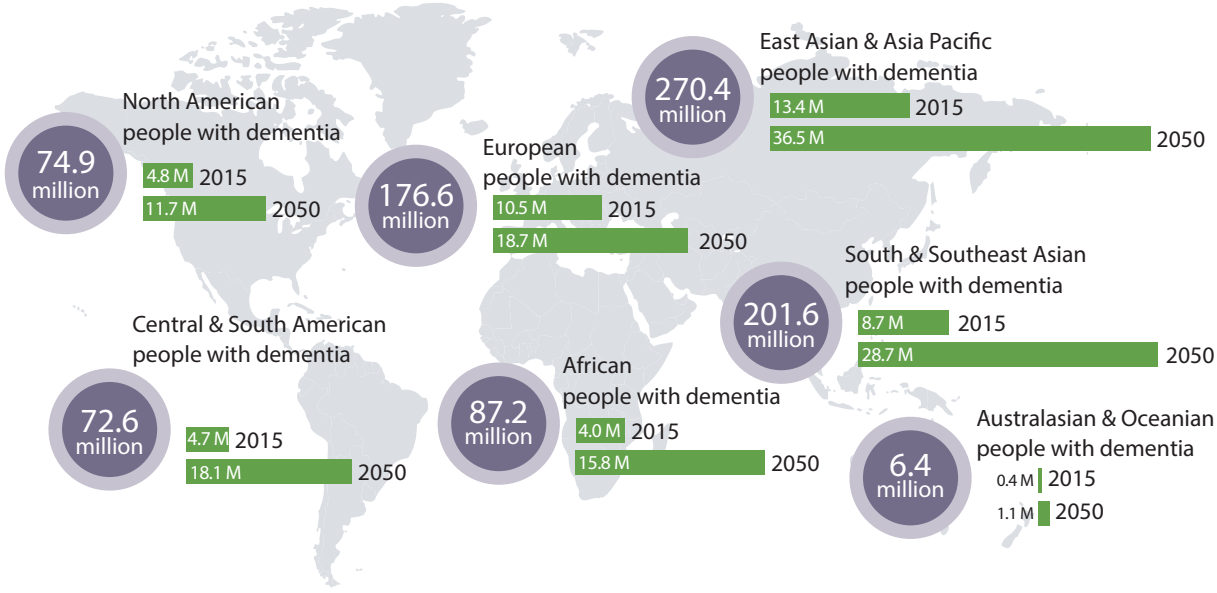


- Brains of people affected with **Alzheimer's** disease have a build up of toxic clusters of proteins called amyloid-β and tau. These proteins may contribute to significant brain shrinkage and damage to brain cells. This particularly occurs in the areas of the brain related to memory and thinking.
- Researchers do not completely understand what causes **Alzheimer's** disease. Current research efforts are ongoing to fill the gaps in our understanding of the disease.
- New treatments targeting key proteins of the disease process in **Alzheimer's** disease are emerging.

What is the estimated number of global cases of dementia?

- Since the average life expectancy has increased, the number of people with age-related brain diseases such as **Alzheimer's** disease will rise significantly.
- Worldwide, an estimated 46.8 million people were living with all forms of dementia in 2015. This number is expected to reach 131.5 million in 2050.

Estimated growth in dementia relative to size of the aged 60+ population by region



What is a biomarker?

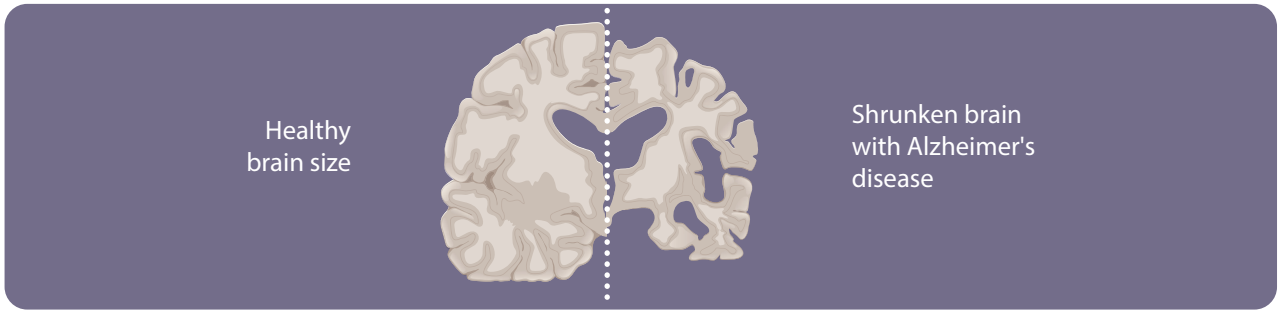
- Biomarkers (short for biological markers), are measures that reflect what is happening inside the body at any given moment. They can be an indicator for early signs of disease or disease progress.
- Biomarkers can be measured by scanning the body or analyzed in body fluids such as blood, urine, saliva, or **cerebrospinal fluid**. Some diseases can be detected even before people experience symptoms.
- Biomarkers can provide detailed information on abnormal changes in the brain. This can help guide timely diagnosis, prognosis, and treatment decisions to ensure the most accurate approach to care for people with **Alzheimer's** disease.
- Biomarkers may play a key role in selecting people for clinical studies. In the future, they may help in choosing people most likely to benefit from a treatment.
- Biomarkers can potentially help monitor the effectiveness and side effects of new and existing treatments.

What is the importance of biomarkers in Alzheimer's disease?

- Biomarkers can help confirm diagnosis of **Alzheimer's** disease. They play an increasingly important role in various steps along the journey of people with the disease.
- Currently, diagnosis is often made by observing symptoms using mental status tests that asseses a person's thinking and memory skills; a physical exam to assess a person's coordination, reflexes, and physical ability; blood tests; or brain imaging tests. There is wide evidence supporting the value of biomarkers in the early diagnosis of **Alzheimer's** disease.
- However, biomarkers are not yet used routinely in many centers.

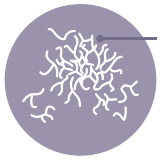
What are the current biomarkers associated with Alzheimer's disease and the AT(N) system?

- In people with **Alzheimer's** disease, proteins known as amyloid-β and tau cluster together to form amyloid plaques and tau tangles. This is accompanied by abnormal brain function and loss of brain cells, known as neurodegeneration. Amyloid plaques, tau tangles, and neurodegeneration are the hallmarks of **Alzheimer's** disease.
- The current system for classifying brain changes in **Alzheimer's** disease consists of detecting three main biomarkers: amyloid (A), tau (T), and neurodegeneration (N). This is known as the AT(N) system.
- These biomarkers are useful in accurately diagnosing people with **Alzheimer's** disease. They can be detected in blood, **cerebrospinal fluid**, or with brain scans.

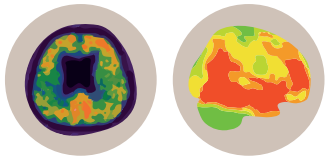


Biomarkers **Brain scans**

Amyloid

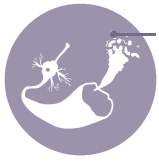


Amyloid PET

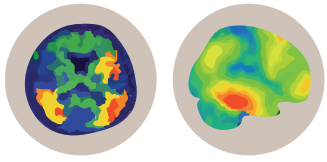


Amyloid PET scanning makes the amyloid plaques light up on the scan. The bright colored areas indicate increased build up of amyloid plaques in the brain. This is one of the earliest changes observed in the brains of people with Alzheimer's disease

Tau



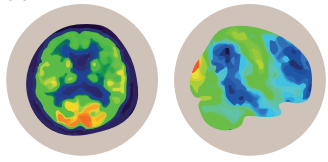
Tau PET



Tau PET scanning makes the tau tangles light up on the scan. The bright colored areas show increased accumulation of tau tangles in the brains of people with Alzheimer's disease

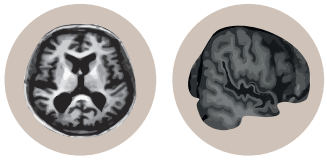
Neurodegeneration

Metabolic PET



Metabolic PET scanning makes brain areas that have abnormally low brain activity light up. The low metabolic activity is suggestive of damage to brain cells. This is a common finding in the brains of people affected with Alzheimer's disease

MRI



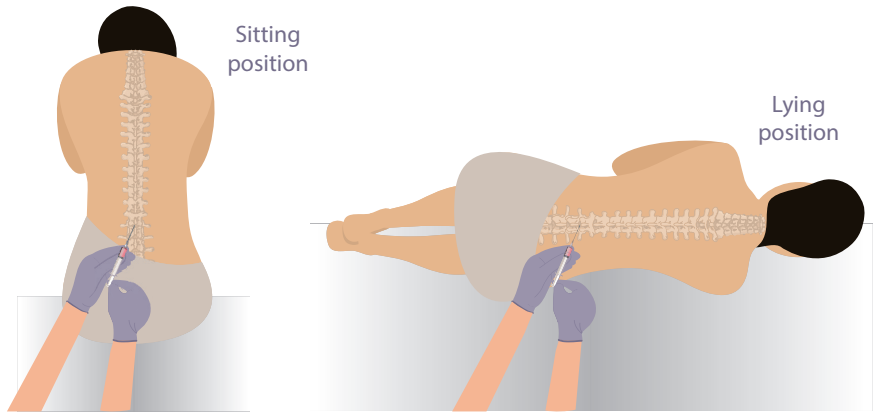
MRI scanning shows the size and structure of the brain. The darker regions indicate thinning and shrinkage of the brains affected with Alzheimer's disease

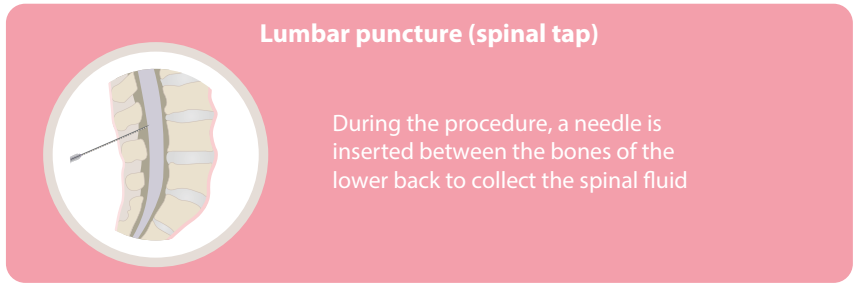
PET: Positron emission tomography; MRI: Magnetic resonance imaging.

What is a lumbar puncture?

- **Lumbar puncture**, sometimes referred to as spinal tap, is a medical procedure that involves inserting a needle into the lower spine (also known as lumbar region) to collect a sample of **cerebrospinal fluid**. This fluid surrounds the brain and spinal cord. The needle is placed well below the end of the spinal cord and cannot injure the spinal cord.
- **Lumbar puncture** is used to diagnose and treat different health conditions. It can be used to measure biomarkers associated with **Alzheimer's** disease in the **cerebrospinal fluid**, which can help guide timely diagnosis and treatment.

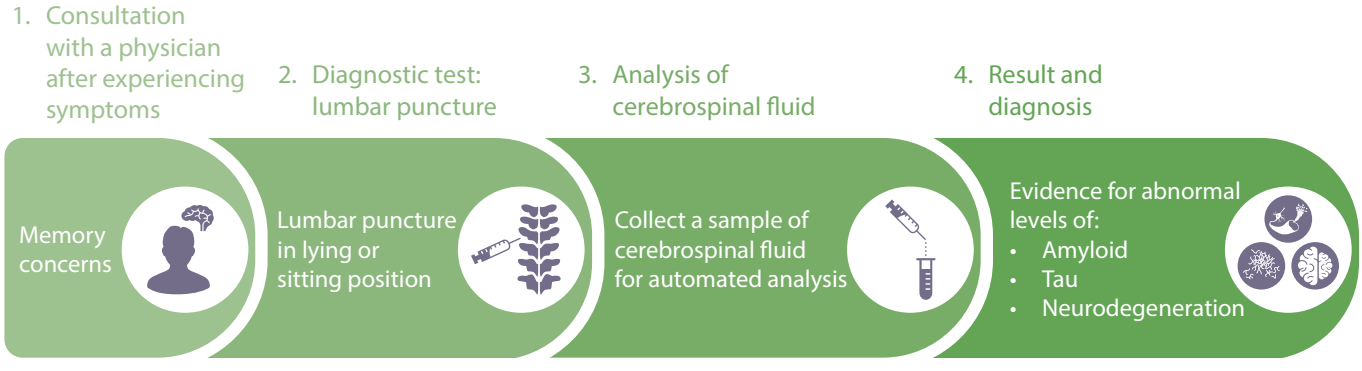
People can have a lumbar puncture in either a sitting or lying down position



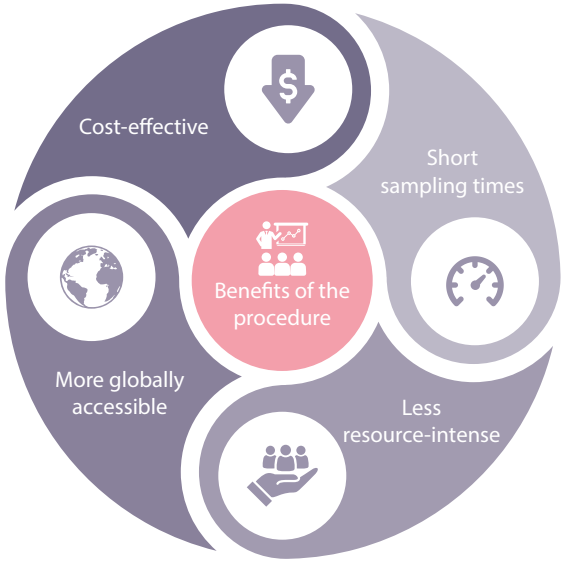


What are the steps involved when using lumbar puncture for diagnosis of Alzheimer's disease?

The following diagram shows the steps involved in the lumbar puncture procedure



What are the benefits of using lumbar puncture compared with brain imaging techniques for diagnosing Alzheimer's disease?



What are the current barriers to widespread use?

People-related

Anxiety

- Due to little or no prior experience of having the procedure
- Due to not having seen a video/visual demonstrationof the procedure

Lack of awareness

- On the importance of early diagnosis
- On the importance of biomarkers for early diagnosis

Hesitancy

- Due to lack of understanding on the importance of early diagnosis
- To get a diagnosis of Alzheimer's disease since a diagnosis is thought to be of limited value in the absence of an effective treatment

Physician and practitioner-related

Concern

- Due to lack of confidence and experience of performing the procedure
- Due to the invasiveness of the procedure and associated side effects

Lack of education and training

- On the principles of performing the procedure safely
- On how to interpret biomarker test results
- On the importance of biomarkers for early diagnosis

Perception that diagnosis is not important

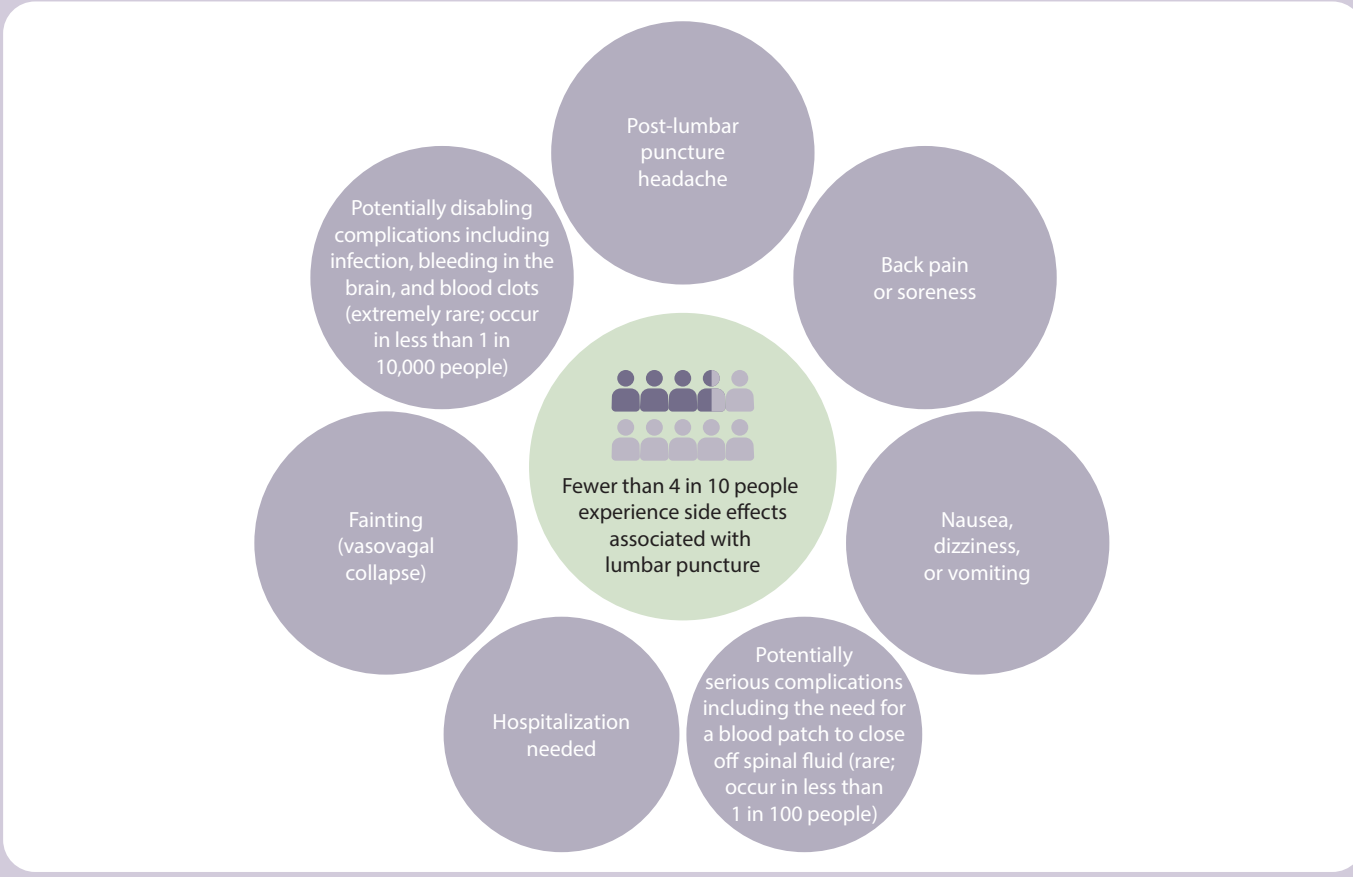
- Due to lack of available clinical guidelines
- Recommendations for optimal practice

Health system infrastructure-related barriers

- Insurance coverage conditions
- Resource and time constraints

What are the adverse events?

- Adverse events are side effects that can cause harm to the body. Adverse events associated with **lumbar puncture** are uncommon. Multiple studies in **Alzheimer's** disease indicate that a **lumbar puncture** can be performed safely with less than 1 in 100 people experiencing serious side effects.
- People who experienced serious adverse events recovered completely after treatment.



What are the risk factors for headache after a lumbar puncture?

People-related factors that increase the risk of headache after a lumbar puncture

- Female sex
- Body mass in the normal or underweight range (BMI less than 25 kg/m^2)
- Younger age
- Fear of procedure and side effects
- Past history of headaches
- Lack of experience

BMI: Body mass index.

What is the guidance for a safe lumbar puncture?

The following points can help trained clinicians and/or trained medical staff to perform lumbar punctures safely

Pencil-point (atraumatic) narrow-bore needle that is more than or equal to 22 gauge
- Reduces side effects
- Decreases pain and discomfort
- Lowers the need for medical intervention for side effects
- Lowers risk of blood going into the spinal fluid sample
- Less risk of spinal fluid leakage

Lying down is the preferred position
- Sitting position might be associated with a higher risk of severe headache
- Short rest by lying down after the procedure is common practice, but prolonged periods are not required for most people

Education and training of physicians and practitioners
- Educate physicians and practitioners about the importance of an early diagnosis
- Procedure can be performed safely and effectively by trained physicians and practitioners
- Effective training through goal- and learner-centered video or simulation-based training

Communicate effectively with patients and caregivers
- Explain medical terminology to overcome misunderstandings and alleviate fears
- Show informative videos to reassure people about the procedure
- Educate people and caregivers about the importance of an early diagnosis

Avoidance of repeated attempts
- Stop procedure after four unsuccessful attempts

Passive withdrawal of spinal fluid
- Do not "pull" cerebrospinal fluid out with a syringe; let it drop from the needle

Tube filling volume (less than 30 mL)
- Do not fill tubes with more than 30 mL of cerebrospinal fluid, using the tube specific for Alzheimer's disease testing

Aftercare
- Caffeine and pain relief tablets can help treat mild headache after the procedure

When should a lumbar puncture be performed to diagnose Alzheimer's disease?

Lumbar puncture can be considered for anyone who may have Alzheimer's disease. For example:

People with memory problems and risk factors for Alzheimer's disease

People with memory problems that are persistent, getting worse, and unexplained

People with symptoms suggestive of possible Alzheimer's disease

People who show a change in behavior and are being considered for a diagnosis of Alzheimer's disease

People who develop mild cognitive impairment or dementia before the age of 65 years

People with no specific reasons not to have a lumbar puncture

What are the take-home points from this summary?

- **Lumbar puncture** is a safe method of obtaining **cerebrospinal fluid** to test for biomarkers associated with **Alzheimer's** disease.
- With proper training, potential adverse events can be reduced.
- Results from a **lumbar puncture** can provide valuable diagnostic information of all the AT(N) biomarkers. This can be used to confirm or rule out **Alzheimer's** disease.

Where can readers find more information?

The review article discussed in this summary, called 'State-of-the-art of **lumbar puncture** and its place in the journey of patients with **Alzheimer's** disease', was published in *Alzheimer's & Dementia* in May 2021. It is free to read at: https://alz-journals.onlinelibrary.wiley.com/doi/10.1002/alz.12372

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