

ASERNIP/S



**Australian Safety
and Efficacy
Register of New
Interventional
Procedures –
Surgical**

Consumer summary

Minimally invasive surgery for primary hyperparathyroidism (Update & Reappraisal)

(Adapted from the report of the Review Group for consumer use by Ms D. DeNichilo)

To navigate in this document in Word:

- Click on the word (underlined in blue) to link to glossary.
- Use back arrow on tool bar to return to original place in document.

The intent of this review by ASERNIP-S was to systematically review the medical literature regarding minimally invasive parathyroid surgery for patients with primary hyperparathyroidism (PHPT) with respect to its safety and effectiveness. In addition to the findings of the review and the recommendations made by ASERNIP-S to the Royal Australasian College of Surgeons, some background information on primary hyperparathyroidism has been provided.

What is Primary Hyperparathyroidism?

Primary hyperparathyroidism is a condition in which the parathyroid glands are overactive, in so far as they produce excessive amounts of the parathyroid [hormone](#). The parathyroid glands are small glands about the size of a grain of rice. There are usually four glands, which are located in the neck behind the thyroid gland, and belong to the [endocrine system](#) of the body.

The sole role of parathyroid [hormone](#) is to control the level of calcium in the blood. Calcium is a mineral, which plays an essential part in the operation of the nervous and musculo-

skeletal systems. When one or more of the parathyroid glands are diseased, they become overactive and the blood levels of calcium are no longer regulated.

Under normal circumstances, when calcium in the blood is too high, the cells of the parathyroid glands make less parathyroid [hormone](#) or they stop making it altogether. If excessive amounts of parathyroid [hormone](#) are present in the blood, the bones will release calcium (the major structural component of bones) into the blood at an excessive rate. This results in an exaggerated loss of bone density and eventually [osteoporosis](#) develops.

Over-activity of the parathyroid [hormone](#) is generally caused by the development of a [benign tumour](#) of the parathyroid glands, known as an [adenoma](#). In a small percentage of patients with hyperparathyroidism, all four parathyroid glands can be enlarged. This condition is referred to as [hyperplasia](#). Although rare, it is also possible to have two or more parathyroid [adenomas](#). In [hyperplasia](#) or with [adenomas](#), the excess production of parathyroid [hormone](#) continues despite a high calcium level. Hyperparathyroidism should not be ignored, as elevated calcium levels in the blood can cause other serious problems including [gastric ulcers](#), [pancreatitis](#), and [kidney stones](#).

How do you know if you have Primary Hyperparathyroidism?

Primary hyperparathyroidism occurs in about one in every 1000 individuals and as frequently as one in every 500 women over 60 years of age. Unfortunately many people with PHPT are unaware they have the condition due to the subtle nature of the symptoms. Some may not appreciate their poor health until after surgery when they start sleeping better at night, feel less irritable and find their memory improves as well as their energy levels. A routine test of the blood's [biochemistry](#) will detect elevated levels of calcium, prompting further investigation such as measurement of parathyroid [hormone](#) levels.

Treatment of Hyperparathyroidism

Fortunately, PHPT is a surgically correctable disease with a success rate of up to 98% at initial surgery by an experienced surgeon performing the standard technique known as 'Standard Bilateral Open Neck Exploration'. There is general agreement that patients with PHPT should be considered for surgery, particularly those patients with a high blood calcium level who are [symptomatic](#). Some patients with PHPT who have a high blood calcium level,

and are [asymptomatic](#) may be closely medically monitored rather than operated on. However, evidence from population-based studies suggests that untreated patients with PHPT have a greater risk of dying from [cardiovascular disease](#) and [malignancy](#), when compared with their counterparts of comparable age and gender in the normal population. This increased risk of death can be reduced, and possibly eliminated, when treated surgically.

Standard Bilateral Open Neck Exploration

The standard bilateral open neck exploration of the parathyroid glands has been considered the “gold standard” treatment for PHPT since 1925. This procedure involves the removal of the enlarged gland(s) via a 3 - 4 cm collar incision to each side of the neck, usually under general anaesthesia. The surgeon mobilises the thyroid gland and then explores both sides of the neck to locate the four parathyroid glands, which lie behind the thyroid gland deep in the neck. In 90% of cases only one gland is enlarged, hence, only one gland needs to be removed. The remaining three glands are capable of maintaining normal function. In the event of [hyperplasia](#) in which all four glands are enlarged (5 to 13% of cases), typically 3 or 3½ of the enlarged glands are removed. The small quantity of parathyroid tissue remaining is then able to maintain normal function.

Surgical failure can occur due to a variety of reasons, including a gland’s [ectopic](#) position (possibly in the chest), undetected multi-glandular disease, the presence of [supernumerary](#) glands or lack of surgical experience.

The standard bilateral open neck exploration has been shown to be successful in 95% to 98% of cases when performed by an experienced [endocrine](#) surgeon. Complications include temporary damage to the nerves of the [larynx](#) and abnormally low levels of blood calcium after surgery. The latter necessitates the need for calcium and vitamin D supplementation, although usually on a temporary basis.

Unilateral [Cervical](#) Approach

The unilateral [cervical](#) approach is an alternate to the “gold standard” approach. In this procedure only one side of the neck is explored and two parathyroid glands examined in the hope that the overactive parathyroid gland(s) will be located on the side of the neck explored.

The perceived advantage of this approach is that should secondary surgery be necessary, the unexplored side of the neck is undisturbed and hence there is a reduced risk of recurrent [laryngeal nerve](#) damage. It may also reduce the duration of the primary operation. The evidence for this claim is mixed. It appears that the operative time relates to the experience of the surgeon rather than the procedure undertaken.

The primary concern with the unilateral approach is that it can fail to detect multi-glandular disease or a [tumour](#) on the unexplored side of the neck. It has been reported that half to two thirds of patients who have multiple [adenomas](#) will have a missed [tumour](#) on the unexplored side of the neck. For this reason, this technique is not popular with all parathyroid surgeons.

[Imaging](#) procedures for detection of abnormal parathyroid glands

In order to maximise the probability of accurately identifying overactive glands before surgery and minimising the incision at surgery, various techniques referred to as localisation studies have been developed. These include the use of [ultrasound](#) and [isotope scanning](#), namely, technetium-thallium scanning and technetium-sestamibi scanning.

High-resolution [ultrasound](#) has been shown to localise parathyroid [adenomas](#) with a sensitivity of about 70%. However, it requires a skilled operator in order to reach these levels of sensitivity and generally this method attains an accuracy of only 50%. One limitation of [ultrasound imaging](#) alone is that thyroid [nodules](#) may be mistaken for parathyroid [adenomas](#).

Some surgeons have used [ultrasound](#) to locate the diseased gland(s) and combined this with a rapid or [quick parathyroid hormone estimation](#) during surgery. A marked fall in the level of parathyroid [hormone](#) establishes whether the removal of suspected abnormal parathyroid glands has been successful. However, [quick parathyroid hormone estimation](#) is an expensive technique and not yet fully accepted as reliable.

[Isotope scanning](#) entails the administration of a very small dose of a [radioactive material](#) (technetium-thallium or technetium-sestamibi) to the patient. The [radioactive material](#) concentrates in the overactive parathyroid glands. The radioactive glands can be detected either before surgery by standard scanning or during surgery using a hand-held scanning probe. The probe is inserted into the incision and moved to where the radioactivity is

detected, allowing the radioactive gland to be located. This technique using sestamibi has been shown to be particularly effective, with a detection rate of up to 90% in some countries. However, in Australia the average detection rate is only 50% at present.

Minimally invasive techniques for parathyroid surgery

The minimally invasive approach merely combines the [imaging](#) procedures described above with the unilateral [cervical](#) approach using a smaller surgical incision. The advantages of this approach are that the procedure can be performed under local anaesthesia and it is generally associated with a shorter hospital stay.

Although numerous minimally invasive parathyroidectomy techniques have been described in the literature, most authors have only reported on their patients who have undergone such surgery, rather than compare the outcome of the surgery with other comparable patients who have had the traditional ‘gold standard’ procedure of bilateral neck exploration.

The [endoscopic](#) approach is yet another minimally invasive approach performed after [isotope scanning](#) for the surgical removal of the parathyroid glands. It involves a small incision to the neck through which carbon dioxide gas may be pumped in to expand the size of the operative area, thereby maximising visualisation. This technique is known as [gas insufflation](#). Tissue lifting devices may be used instead of CO₂ to enhance visualisation. An [endoscope](#) is then inserted into the space and used to visualise the parathyroid glands before they are [resected](#). This approach can be compromised by the presence of blood obscuring the surgeon’s view. This is a technique that requires an [endocrine](#) surgeon experienced in [endoscopic](#) techniques.

Is minimally invasive parathyroid surgery safe?

[Mortality](#)

It would appear that from the body of evidence reviewed, that [mortality](#) has not as yet been reported in any of the minimally invasive surgical approaches to the removal of overactive parathyroid glands, although at present the number of procedures reported are small.

Complications

The literature reviewed indicates that the complications arising from the above-mentioned surgical procedures are usually minimal, but lengthy [gas insufflation](#) has been implicated with

significant problems. As with the conventional surgical approach, minimally invasive techniques also carry a risk of temporary damage to the [laryngeal nerve](#), resulting in [laryngeal nerve palsy](#).

The [endoscopic](#) approach has been reported to be associated in a few cases with the rupture of the [adenoma](#), when its removal is being made through a very small incision or through the narrow exit wound and tubing known as an endoscopy port or [cannula](#). The resultant spillage of cells can lead to [parathyromatosis](#). Another risk associated with the [endoscopic](#) approach is the development of [subcutaneous emphysema](#). Serious [haemorrhage](#) has also occurred on rare occasions.

Is minimally invasive parathyroid surgery effective?

To be effective, minimally invasive surgery for primary hyperparathyroidism requires accurate localisation of the abnormal glands, careful selection of patients, and a skilled and experienced surgeon.

To ensure a good surgical outcome when the minimal approach to surgery is used, it is prudent to ensure that a presumed solitary [adenoma](#) is identified and that patients likely to have [hyperplasia](#) or multiple gland disease are excluded. These include patients with any of the following;

- kidney disease,
- a family history of parathyroid disease,
- suspected [multiple endocrine neoplasia syndrome](#),
- a [nodular goitre](#),
- previous neck surgery and/or prior [irradiation](#) to the neck,
- [lithium](#) associated primary hyperparathyroidism,
- abnormal neck structure (skeletal or soft tissue).

Additionally, it is essential that the surgeon is experienced in the conventional technique should the minimally invasive approach need to be converted to the standard bilateral neck dissection. With adequate guidelines and with experience, a success rate of close to 90% should be achieved.

Recommendation to the Royal Australasian College of Surgeons

The Royal Australasian College of Surgeons has endorsed the ASERNIP-S recommendation that minimally invasive techniques for primary hyperparathyroidism be classified as level '2' procedures, that is, 'the safety and efficacy of the procedures cannot be determined at the present time due to an incomplete and poor quality evidence-base'. However, this review does not examine any cost-benefits. A further recommendation was that the procedures should only be undertaken in the setting of a controlled study with ongoing monitoring under the supervision of the Section of [Endocrine](#) Surgery of the Royal Australasian College of Surgeons. There are numerous types of minimally invasive parathyroidectomy procedures and as yet no firmly established technique has been accepted as the 'gold' standard. Therefore, ongoing monitoring and further studies need to be performed and reported to ensure that minimally invasive parathyroidectomy reaches the high degree of satisfaction noted with a standard open bilateral neck exploration for hyperparathyroidism.

Evidence Update – Year 2001

An update of the information available on minimally invasive parathyroidectomy techniques was undertaken by ASERNIP-S in June 2001. Based on the updated evidence it was found that the original recommendations made by the Royal Australasian College of Surgeons for the use of these techniques should remain the same.

Acknowledgements

[Endocrine](#) Disorders & [Endocrine](#) Surgery (www.endocrineweb.com)

Key words: parathyroid surgery

June 2001

Important Note: The information contained in this report is a distillation of the best available evidence located at the time the searches were completed as stated in the protocol. Please consult with your medical practitioner if you have further questions relating to the information provided, as the clinical context may vary from patient to patient.

For further information about ASERNIP-S

Contact Professor Guy Maddern, ASERNIP-S Surgical Director, PO Box 688, North Adelaide, SA 5006, ph. (08) 82391144, fax (08) 82391244, or visit the website (www.surgeons.org/asernip-s).

If you would like to provide feedback on this consumer summary, please contact us at consumer.asernip@surgeons.org.

ASERNIP-S is a programme of the Royal Australasian College of Surgeons (RACS).

Glossary

Adenoma: a [benign tumour](#) of one or more parathyroid glands.

Asymptomatic: free of symptoms or not causing symptoms.

Benign: a [tumour](#) which enlarges locally, not invading tissue or spreading remotely, as opposed to a malignant [tumour](#), which establish secondary growths elsewhere in the body.

Biochemistry: the study of the chemical processes going on in living organisms.

Cannula: a hollow surgical tube inserted into the skin so that fluid or other material may be passed.

Cardiovascular disease: any disease of the heart or blood vessels.

Cervical: pertaining to the neck. This may be the neck of the body, or the neck of an organ such as the womb.

Ectopic: situated in a place remote from the usual location.

Endocrine system: a system comprised of numerous glands, which produce and release highly active chemical substances into the blood that circulate to affect cells, tissues, organs or the entire organism.

Endoscope: an internal viewing instrument. Modern endoscopes are steerable, flexible, cylindrical instruments with fibre optics for illumination and viewing and channels to allow

washing of the area under view, suction, gas inflation to ease viewing, the taking of biopsy specimens and the use of various small operating instruments, including lasers.

Endoscopic: using an [endoscope](#).

Gas insufflation: the blowing of gas into a body cavity.

Gastric Ulcers: a defect in the lining of the stomach as a result of the loss of mucus and other protection against the action of acid and digestive enzymes.

Haemorrhage: an abnormal escape of blood from an artery or vein.

Hormone: an organic chemical substance secreted by a cell or group of cells which diffuses in body fluids to act on other cells nearby or remotely.

Hyperplasia: an increase in the number of cells in a tissue or organ causing an increase in the size of the part. Hyperplasia is not a cancerous process.

Imaging: producing images for use in diagnosis.

Irradiation: exposure to radiation for purposes of treatment or to sterilise medical or surgical material and instruments.

Isotope scanning: the use of radioactive elements incorporated in molecules of substances that can safely be introduced into the body, or into certain blood cells, and which tend to concentrate in particular organs, parts or diseased areas, such as [tumours](#).

Kidney Stones: crystallisation out of various substances dissolved in the urine, especially during dehydration when the urine is most concentrated.

Laryngeal nerve: the nerve pertaining to the [larynx](#) or voice box.

Larynx: voice box. Located at the upper end of the windpipe or trachea.

Lithium: an element, the lightest known solid, used as the citrate or carbonate salts for the control of manic depressive states.

Malignancy: a term usually applied to cancerous [tumours](#) but also used to qualify serious forms of diseases tending to cause death unless effectively treated. The term is opposite in meaning to [benign](#).

Mortality: death, loss of life.

Multiple endocrine neoplasia syndrome: an autosomal disorder (genetic disorder caused by genes carried on chromosomes other than the sex chromosomes), characterised by parathyroid [adenoma](#), islet cell [tumours](#) of the pancreas, and pituitary [tumours](#).

Nodular goitre: a swelling of the thyroid gland that features multiple, small, hard lumps.

Nodules: small, solid-like lumps of tissue occurring anywhere in the body.

Osteoporosis: loss of bone density due to excessive absorption of calcium and phosphorus from the bone. At an advanced stage, bones become brittle and prone to fracturing.

Palsy: paralysis.

Pancreatitis: inflammation of the pancreas.

Parathyromatosis: a condition in which multiple seeds of parathyroid tissue regrow.

Quick parathyroid [hormone](#) estimation: the level of parathyroid [hormone](#) is checked during surgery by a rapid method.

Radioactive material: a substance emitting radiation.

Resected: surgical removal of any part of the body or of diseased tissue.

Subcutaneous emphysema: the escape of gas into the tissues beneath the skin around the face, neck and chest following the insufflation of carbon dioxide gas under pressure.

Supernumerary: more than the normal number.

Symptomatic: a sign of the existence of a condition, especially a perceptible change from what is normal in the body or its functioning.

Tumour: any mass of cells resulting from an abnormal degree of multiplication.

Ultrasound scanning: a method of body [imaging](#) based on the reflectivity of sound.