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Does the surgical approach affect quality of life outcomes? – A comparison of minimally invasive parathyroidectomy with open parathyroidectomy[☆]

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KEYWORDS

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Abstract *Background:* Quality of life has been shown to improve significantly after successful parathyroid surgery and normalisation of serum calcium levels. What is not known is how much of that effect is related to the patient's perception of their procedure, and whether or not patients may perceive that a minimally invasive operation provides a better outcome than that of an open procedure.

Methods: Two hundred and two consecutive patients who had undergone parathyroid surgery were selected for telephone interview. Of that group, 152 had had an open parathyroidectomy and 50 a minimally invasive approach, either an endoscopic assisted or a direct minimal access approach. Post-operative quality of life was assessed with both the Short Form-36 Health Survey (SF-36) and a disease-specific questionnaire. The SF-36 results were compared with a matched Australian population.

Results: Patients who underwent a direct minimal access parathyroidectomy had significantly better vitality and emotional role limitation scores than those having an open procedure. The health status scores of all patients having surgery for primary hyperparathyroidism were significantly lower in five out of the eight domains than those of a matched Australian population. There was a significantly lower incidence of post-operative symptoms in the minimally invasive group as a whole.

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Conclusions: Minimally invasive parathyroidectomy is associated with a greater improvement in post-operative quality of life than the open technique despite the fact that both result in equivalent normalisation of serum calcium levels. It is not clear if this is due to differences in the technique itself or is related to the patients' perceptions of having had a "less invasive" surgical procedure.

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Introduction

Several prospective studies have reported that patients have retained or improved their quality of life after open surgery for primary hyperparathyroidism,^{1,2} a change which has been attributed to normalisation of the biochemical changes associated with hyperparathyroidism. In recent years, minimally invasive approaches to parathyroid surgery have been promoted widely and reports of outpatient procedures under local anaesthesia with same day discharge are starting to appear in the literature.^{3,4} Advantages such as better cosmetic results and reduced post-operative pain are often postulated as a general consequence of any minimally invasive intervention. It has also been claimed that such procedures are better tolerated and result in improved post-operative patient outcomes. No one, however, has yet compared outcome of quality of life data following minimally invasive parathyroidectomy with the open procedure.

Traditional measures of morbidity and mortality are now thought to be inadequate to assess patient outcomes.⁵ Self-perceived quality of life is becoming more important than just clinical outcome because patients ultimately have to live and cope with any deficit from a medical intervention. Furthermore, policymakers and health trusts are beginning to base their decisions on quality of life measures. The Short Form-36 (SF-36) questionnaire is widely regarded as one of the most useful generic instruments for assessing a patient's self-perceived quality of life.⁶ Initial studies in the UK have shown that the SF-36 is reliable, reproducible and sensitive.^{7,8} The aim of this study was to compare quality of life after open and minimally invasive parathyroid surgery.

Methods

A telephone-based quality of life questionnaire study was offered post-operatively to the first 50 consecutive patients who have undergone minimally invasive parathyroidectomy (MIP) for primary hyperparathyroidism in the Endocrine Surgical

Unit, University of Sydney, Sydney, Australia during the period May 1998–October 1999. The same interview was offered to a further 152 consecutive patients, who had open parathyroidectomy over the same period of time.⁹ All patients were more than 6 months following their parathyroid surgery. This was a cohort study and analysed as case-control. It was non-randomised but was blinded with respect to the conduct of the telephone interviews. We also compared our surgical population with data from an age- and sex-matched Australian population provided by the Australian Bureau of Statistics. The size of the matched group was 179 people.

Patients were contacted by phone and those agreeing to participate were asked to complete the Australian arm of the Medical Outcomes Short Form-36 (SF-36) health status questionnaire over the telephone and to answer a structured questionnaire concerning disease-specific symptoms as well as co-existing health problems they may have. Patients were not given any help to interpret the questions as recommended by Ware et al.¹⁰ but the questions were repeated slowly if required. Patients were excluded from the study if they did not understand English or had comprehension difficulties. The interviewer was blinded such that he did not know at the time of interview or subsequent data analysis whether the patient underwent minimally invasive or open surgery.

The SF-36 health status questionnaire was developed by the RAND Corporation, during the US Medical Outcomes Study (MOS), under contract to the Health Care Financing Administration. The SF-36 instrument consists of 36 simple questions that when scored and aggregated define eight domains of health status. They encompass general health perception (GH), physical function (PF), physical (RP) and emotional (RE) role limitations, social function (SF), mental health (MH), bodily pain (BP) and vitality (VT). The number of questions that contribute to each domain varies from two to 10. Value responses range from one to six. All scales are then standardised from 0 to 100, with higher scores representing better health status. The SF-36 is usually supplemented by condition-specific questions that are most pertinent to the specific

disease or condition under surveillance.² This is known as a specific instrument and it focuses on problems associated with single disease states, patient groups or areas of function. We supplemented the SF-36 survey questions with additional items that focus on whether patients have residual complications of primary hyperparathyroidism after surgery.

All surgical procedures were performed by, or under the supervision of one of the authors (LD) and were all carried out under a general anaesthetic. Selection for MIP was based on an unequivocal identified single site of uptake on a preoperative parathyroid Sestamibi scan. Otherwise the patient underwent open surgery. The surgical techniques used have been described in detail elsewhere.⁹ All patients provided written informed consent to participation in research studies involving data collection, storage and analysis in relation to their surgery, as well as post-operative follow-up in relation to outcomes and satisfaction. This study was approved by the local research ethics committee.

Statistical analysis

Analysis and scoring of the SF-36 data were performed according to the guidelines developed by Ware.¹¹ Normal population data, age- and sex-matched, were supplied by the Australian Bureau of Statistics. All data are expressed as means \pm 1 standard deviation. The differences were analysed at the level of $p = 0.05$ using the non-paired Student's *t*-test for parametric data. For qualitative data the non-parametric test of significance of Chi-square and Fischer's exact test was applied when an expected count of a single cell of a contingency table was less than five.

Results

Of the 202 consecutive patients who underwent parathyroidectomy in our unit in the 17-month period May 1998–October 1999, we were able to recruit 179 patients (89%) for our study. Of the 23 patients who were not included, 7 (30%) were not reachable, 4 (17%) were deceased, 3 (13%) had dementia, 5 (23%) declined outright and 4 (17%) had difficulty understanding English or communicating. There were 48 patients in the minimally invasive (MIP) group and their mean age was 62.9 years (range, 27–87 years) with a male:female ratio of 10:38. There were 131 patients in the open (OPEN) group and their mean age was 61.8 years (range, 20–84 years) with a male:female ratio of

27:104. There were no statistically significant differences between the two groups. Of the 48 patients interviewed who had undergone a minimally invasive procedure, 32 had an endoscopically assisted (MIPE) approach and 16 a direct lateral minimal access (MIPs) approach. There were no significant differences not only in time from surgery to study between the three groups but also in outcome between the groups with respect to normalisation of serum calcium levels, with one patient (2%) in the minimally invasive group and three patients (2%) in the OPEN group having persistent hyperparathyroidism.

Table 1 shows the mean \pm SD of SF-36 scores among the three groups. We found that the patients who had undergone the MIPs approach had significantly better GHP ($p = 0.04$) and VT ($p = 0.01$) domain scores than those who had undergone the MIPE approach. MH ($p = 0.07$) and RE ($p = 0.09$) scores, although showing a trend, were not significantly different. Patients in the MIPs group also had significantly higher VT ($p = 0.003$) and RE ($p = 0.02$) scores than those in the OPEN group. There were no significant differences when MIPE was compared with the OPEN and, interestingly, no significant differences in the eight parameters when all the minimally invasive patients (MIPE + MIPs) as a group were compared to their OPEN counterparts.

The health status scores of all patients having had surgical correction for primary hyperparathyroidism were significantly lower in five out of the eight domains than those of an age- and sex-matched Australian population. However, the elements of PF, BP and MH were not significantly different between the two populations. We found that RE was only significantly different when comparing the entire MIP group with the normal population. The health domains of RP, GHP, VT, SF and RE were significantly lower in the OPEN group in comparison to the general population.

Table 2 summarises the results of the responses to the condition-specific symptoms. Most patients reported co-existing medical problems. The most frequently reported conditions were hypertension and osteoporosis. Complaints ranged across all body systems. Comparing post-operative specific symptoms and signs between the MIP and OPEN groups, we found that there was statistically significant lower incidence of irritability ($p = 0.007$), pins and needles ($p = 0.000$), swallowing problems ($p = 0.001$) and wound healing problems ($p = 0.011$) in the MIP group as a whole compared to the OPEN group. Sleep disturbance showed a trend but was not significant ($p = 0.090$). The MIPE group reported significantly better

Table 1 Distribution of SF-36 scores among the three patient groups

	PF	RP	BP	GHP	VT	SF	RE	MH
Average (all)	70.1	60.2	65.3	59.3	53.9	77.9	62.2	74.8
Std. dev.	25.7	36.9	29.7	23.2	19.2	24.9	31.1	15.7
Confidence interval	3.5	5.1	4.1	3.2	2.7	3.4	4.3	2.2
MIPe	67.2	58.6	62.6	56.1	53.0	76.6	62.5	71.3
Std. dev.	22.3	35.1	30.0	18.3	18.6	26.9	35.7	14.9
MIPs	74.4	65.6	71.6	68.2	65.3	78.9	79.2	78.8
Std. dev.	23.0	30.1	23.9	18.7	13.4	16.3	29.5	12.1
OPEN	70.3	59.9	65.2	58.9	52.7	78.1	60.1	75.2
Std. dev.	26.8	38.2	30.4	24.6	19.7	25.3	29.6	16.2
Confidence intervals	4.3	6.1	4.9	3.9	3.2	4.0	4.7	2.7
Average MIPall	69.6	60.9	65.6	60.1	57.1	77.3	68.1	73.8
Std. dev. MIPall	22.5	33.4	28.1	19.1	17.9	23.7	34.4	14.4
Confidence intervals	6.2	9.2	7.7	5.2	4.9	6.5	9.7	4.0
Average (normal population)	68.3	70.9	69.5	65.3	60.2	83.0	84.3	75.7
Std. dev.	30.3	38.9	28.1	23.5	23.1	25.2	31.7	18.2
<i>t</i> -Test (MIPe vs. MIPs)	0.311	0.476	0.265	0.042	0.012	0.710	0.095	0.070
<i>t</i> -Test (MIPall vs. OPEN)	0.850	0.863	0.926	0.735	0.158	0.862	0.157	0.556
<i>t</i> -Test (MIPe vs. OPEN)	0.494	0.851	0.668	0.466	0.936	0.777	0.721	0.190
<i>t</i> -Test (MIPs vs. OPEN)	0.524	0.496	0.332	0.086	0.003	0.855	0.024	0.305
<i>t</i> -Test (All vs. normal population)	0.511	0.006	0.156	0.012	0.004	0.044	0.000	0.631
<i>t</i> -Test (MIPall vs. normal population)	0.265	0.561	0.303	0.917	0.255	0.991	0.020	0.400
<i>t</i> -Test (OPEN vs. normal population)	0.913	0.005	0.298	0.003	0.000	0.018	0.000	0.292

Bold values highlight when $p < 0.05$.

symptomatic relief compared to the OPEN group in the parameters of irritability, pins and needles, swallowing and voice problems post-operatively, whereas in the MIPs, swallowing problems was significantly less compared to the OPEN group. The number of patients who had a minimally invasive procedure (either MIPe or MIPs) and who went back to work or daily routine at the same time or shorter than expected was significantly better ($p = 0.004$) compared to those who had the open procedure.

Conclusions

This study examined post-operative quality of life in patients undergoing minimally invasive or open parathyroidectomy for primary hyperparathyroidism using an SF-36 questionnaire and condition-specific assessment. The SF-36 is a generic health status measure that allows comparisons of the burden of illness among diseases and populations applicable to all people regardless of condition. It has been widely used to measure the impact of many different health interventions and is an efficient way to measure health from the patient's

point of view by scoring standardised responses to standardised questions. It is reliable on repeat testing and is well validated in many large community samples.^{12,13} When comparing many of the frequently cited tools, the SF-36 has been shown to score measures of well-being, rather than only the absence of negative emotions.¹⁴ Population norms are also available for many nations including Australia,¹⁵ which would be useful in our study (see later). It has been recognised, however, that the lack of sleep assessment in the SF-36 instrument is a major shortcoming¹⁶ and we have tried to address this issue in our disease-specific questionnaire.

The analysis revealed that patients who had a minimally invasive procedure reported no significantly better quality of life on the whole when compared to those who had an open operation. However, patients who specifically had the small lateral minimal access approach ($n = 16$) were found to have scored better in all eight domains of the SF-36 questionnaire when compared to those who had an endoscopic or open approach, although this was individually statistically significant in only several domains for each comparison. Those who specifically had an endoscopic operation did not report significant better health status,

Table 2 Signs and symptoms reported by patients with primary hyperparathyroidism post-operatively

Symptoms and signs	MIPE <i>n</i> = 32		Chitest: MIPE vs. OPEN	MIPs <i>n</i> = 16		Chitest: MIPs vs. OPEN	OPEN <i>n</i> = 131		MIPall <i>n</i> = 48		Chitest: MIPall vs. OPEN
	Yes	No	<i>p</i> Value	Yes	No	<i>p</i> Value	Yes	No	Yes	No	<i>p</i> Value
Fatigue	14	18	0.365	8	8	0.840	69	62	22	26	0.418
Bone pain	11	21	0.937	3	13	0.474	46	85	14	34	0.455
Muscle weakness	12	20	0.944	8	8	0.361	50	81	20	28	0.671
Confusion	5	27	0.326	5	11	0.540	31	100	10	38	0.690
Irritability	6	26	0.003	6	10	0.457	62	69	12	36	0.007
Pins and needles	4	28	0.000	4	12	0.120	61	70	8	40	0.000
Kidney stones	6	26	0.496	2	14	0.360	32	99	8	40	0.269
Sad for 2/52	10	22	0.623	6	10	0.899	47	84	16	32	0.752
Depressed past year	6	26	0.812	3	13	1.000	27	104	9	39	0.783
Neck mobility	14	18	0.289	6	10	0.290	71	60	20	28	0.137
Swallowing	8	24	0.012	3	13	0.031	65	66	11	37	0.001
Wound	1	31	0.010	2	14	0.520	30	101	3	45	0.011
Voice	6	26	0.496	1	15	0.120	32	99	7	41	0.158
Sleep disturbance	16	16	0.412	11	5	0.061	55	76	27	21	0.090
Choice again	29	3	0.341	15	1	0.301	110	21	44	4	0.188
Osteoporosis	17	15	0.328	7	9	0.986	57	74	24	24	0.440
Hypertension	6	26	0.000	3	13	0.003	76	55	9	39	0.000

when compared to those who had an open exploration.

When compared to a sex- and age-matched population, patient scores at 6 months or more post-operatively were significantly lower in five out of the eight domains. There were no significant differences in the PF, BP and MH dimensions. We conclude from our data that patients overall do not return to or near population norms for most dimensions of patient-reported health status. This is in conflict to Burney et al.'s data,^{1,2} which demonstrated that patients returned to normal following successful parathyroid surgery. However, if we compare just the minimally invasive group to the general population, only one domain of health status was significantly lower. This is in contrast to patients having an open procedure, where five out of the eight domains were significantly worse.

We conclude that patients having a minimally invasive procedure generally have a better perception of their quality of life post-operatively, and/or less post-operative symptoms than those having an open procedure, despite the fact that there was no difference in the percentage of patients being returned to normocalcaemia following surgery using either technique. This is more apparent in those having a direct minimal access approach than those having an endoscopic approach.

Since quality of life has been shown to improve significantly after successful parathyroid surgery and normalisation of serum calcium levels, it is

tempting to speculate that the extent of surgery influences perceptions of outcomes and that patients undergoing minimally invasive parathyroidectomy will report a better post-operative quality of life than will patients undergoing open parathyroidectomy simply because of the added placebo effect of minimal surgery. In other words, it is possible that the measurable improvement of patient reporting functional health status and well-being depends on the extent of surgery employed.

Of course it is also possible that the reduced dissection, lack of division of strap muscles, and smaller skin incision lead to reduced post-operative pain, shorter hospital stay and a quicker recovery, and that those factors secondarily influence the patient's perceptions of their outcome or, indeed, that they truly do feel better following minimally invasive surgery. Since most of the improvement in quality of life has been attributed in the past to normalisation of serum calcium, however, such an effect is more likely to be due to the patient's perception rather than being a real effect.

We recognise that a retrospective study such as this has inherent flaws, such as the assumption that the quality of life of patients in both groups was the same pre-operatively. It would not be unreasonable to assume that patients from the OPEN group would potentially have more complications, as they were more likely to have had other coexistent problems like thyroid disease that

would have not made them suitable for a minimally invasive approach.

Nonetheless the study raises the interesting concept that the extent of surgery does influence perceptions of outcomes and that patients undergoing minimally invasive parathyroidectomy will report a better post-operative quality of life than will patients undergoing open parathyroidectomy. Clearly a larger prospective randomised study is required to answer such a hypothesis definitively.

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