



# SPINAL ANAESTHESIA A PRACTICAL GUIDE



# Spinal Anaesthesia in Day Surgery

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# 1. Introduction

‘Cocainisation of the spinal cord’ was first described by August Bier in 1899<sup>1</sup>. The technique has been refined since that time and has evolved into the modern concept of intrathecal, spinal or subarachnoid block (SAB)<sup>2</sup>. Whilst growing in popularity, SAB has largely been reserved for inpatient surgery. In contrast, anaesthetists in other parts of the world have successfully used the technique for patients undergoing ambulatory surgery.

The face of day surgery in the UK is changing. The population is ageing, obesity is more prevalent and patients present with increasingly complex comorbidity. Many patients are excluded from Day Surgery Units (DSUs) on the grounds of risk associated with general anaesthesia (GA). DSUs are under pressure to relax entry criteria in order to relieve demand on inpatient beds. For some of these patients, SAB may be a safer alternative. If so, they may be eligible for DSU. Moreover, procedures previously considered as ‘inpatient only’ (e.g. prostatectomy and female incontinence surgery) are well suited to SAB in the DSU.

We recently surveyed 27 DSUs in the UK. Eleven units never used SAB, 15 used it occasionally and only 1 unit performed SAB routinely. We believe that wider use of SAB in day surgery is advantageous to the patient and contributes to efficient use of limited healthcare resources.

The aim of this publication is to share the lessons learned during the successful introduction of SAB to a DSU in the UK and to summarise the current literature. Anaesthetic, surgical and nursing perspectives are included as the authors consider a multidisciplinary approach is the key to success.

## **Why consider Spinal Anaesthesia for Day Surgery?**

- Extends access to patients who would normally be excluded for GA (e.g. because of obesity or cardiorespiratory disease)
- Low post-operative morbidity
- High patient satisfaction rates
- Routinely practised in other countries – evidence based.

## 2. Preparation for introducing a new service

### Nurse Education

It is important to prepare nursing staff before introducing SAB to the day surgery unit. Some staff will have little or no experience of nursing patients who have received a neuraxial block. Moreover, they may not feel comfortable when responding to patients' questions.

An appropriate teaching programme might include the following:

- Relevant anatomy and physiology
- Technique for performing SAB
- Nursing care, discharge criteria and complications

Once SAB is in regular use, an annual update and feedback session will be sufficient to keep staff informed.

### Anaesthetist Education

All anaesthetists are familiar with the technique of SAB from their inpatient work. However, we have found that some colleagues may need to be introduced to the concept of *low-dose* SAB. A small dose of local anaesthetic combined with fentanyl alters the quality of the spinal block and the side effect profile.

The following misconceptions regarding perioperative morbidity may need to be challenged:

- Significantly prolonged time to discharge when compared to GA
- High incidence of urinary retention
- Frequent Post-Dural Puncture Headache (PDPH)
- Occasional Transient Neurological Syndrome (TNS)
- Possibility of respiratory depression

Anaesthetists who are concerned about the post-discharge complications of SAB can be reassured from the current evidence that morbidity is low and that a system for routine follow-up will be put in place.

### Surgeon Education

Surgeons may need to modify their techniques slightly. The low-dose SAB technique in particular produces little motor blockade. Some of our orthopaedic colleagues initially encountered minor difficulties introducing arthroscopic instruments into knees where significant muscle tone was preserved. They rapidly adapted and no longer consider this a problem.

### **Patient Information**

Most DSUs already provide information to patients regarding administration of general anaesthesia (GA). It seems reasonable to do the same when using low-dose SAB.

Patient information needs to include a brief description of the technique and the type of surgical procedures for which it might be suitable. It should also include advice and helpline telephone numbers for use in the event of morbidity (e.g. PDPH).

As it is often difficult for pre-assessment nurses to know whether a particular patient will be offered low-dose SAB or GA, it may be practical to combine information for both in a single document (see appendix).

## **3. Patient Selection**

We recently published a series of 400 spinal anaesthetics performed in a district general DSU<sup>2</sup>. The most common operations performed were:

- Arthroscopic surgery on the knee
- Foot surgery
- Tension-free vaginal tape
- Inguinal hernia repair
- Urological surgery.

Worldwide, SAB has been used for most operations below the waist. In our experience, the principal reasons for choosing SAB were:

- Patient preference
- Cardiorespiratory disease
- Obesity
- Gastro-oesophageal reflux

The well-known advantages of SAB apply equally for day surgery patients. They include:

- Fewer problems with respiratory function and airway management
- Patients may observe surgery and discuss options with the surgeon
- Reduction in perioperative venous thrombo-embolic disease
- Reduced incidence of post-operative nausea and vomiting (PONV)
- Immediate return to normal oral intake (particularly for patients with diabetes)
- Reduced 'stage 1' recovery time

In addition, low-dose SAB is associated with remarkable cardiovascular stability<sup>2</sup>. Even patients with relatively fixed cardiac outputs remain stable. Patients with high body mass index (BMI), severe respiratory or cardiac disease may thus be considered eligible for day surgery. *In summary, the option of low-dose SAB may allow a DSU to revise admission criteria with regard to both the operation and the patient.*

## 4. Techniques

### Needles

Spinal needles with ‘pencil-points’ are associated with a lower incidence of PDPH than those with traditional ‘cutting tips’. In general, fine needle gauges are also associated with reduced PDPH. However, the relationship between needle gauge and incidence of PDPH is not linear. Very fine gauge needles are associated with more difficulty in placement and higher failure rates. Use of a 24G pencil-point needle has been associated with PDPH rate of 1–4%<sup>2,3</sup>. We believe that the best choice for day surgery at the present time is a 24G or 25G pencil-point needle. For very large patients, long versions of these needles are available, but are technically more difficult to use. We currently use the Sprotte 24G (Pajunck).

### Speed and direction of injection

Day surgery low-dose SAB is carried out using a small dose of local anaesthetic combined with fentanyl to produce a short acting block. We advocate rapid injection of the local anaesthetic in a sitting position. Increasing the rate of injection has been shown to encourage cephalad spread<sup>4</sup>. We aim for a block that is high enough for the intended surgery (although it will be thinly spread). Slow injections, especially with small volumes of hyperbaric solutions tend to produce low, and occasionally inadequate blocks. The orientation of the needle may also be relevant when injecting small volumes. We suggest directing the needle side-hole towards the side of the operation. It is our impression (although not supported by data) that by doing so the block is enhanced on the operated side.

### Local anaesthetic solutions

In the United Kingdom, the only preparations currently *recommended by the manufacturer* for intrathecal anaesthesia are bupivacaine 5mg/ml ‘heavy’, L-bupivacaine 2.5 & 5mg/ml and ropivacaine 7.5mg/ml. However, bupivacaine 5mg/ml ‘plain’ is in common use. Bupivacaine 2.5mg/ml and lignocaine 10-20mg/ml have also been used.

In the United States, lignocaine has traditionally been the most popular choice. It has a convenient short duration and is associated with a low incidence of urinary retention. However concerns over an association with post-operative transient neurologic syndrome (TNS) have made this agent a less popular choice recently. There are also reports of experience with prilocaine<sup>5</sup> and ropivacaine<sup>6</sup>. Prilocaine in particular appears to produce a block comparable with lignocaine in terms of duration but with a reduced incidence of TNS. Further research is awaited. Adrenaline has been used as an adjuvant although it does not appear to confer an advantage within the setting of day surgery. Clonidine may have potential benefits although data is limited at present. In contrast, fentanyl (a lipophilic synthetic opioid) has been widely and successfully used.

We chose to use bupivacaine combined with fentanyl.

Bupivacaine is associated with a very low incidence of TNS<sup>7</sup> and is the agent currently most familiar to UK anaesthetists. Extent of blockade is largely dependent on the dose of bupivacaine - volume, concentration and baricity appear less important. But how far can the bupivacaine dose be reduced? Addition of 10 mcg of fentanyl has been reported to produce short but effective blocks for arthroscopy of the knee with as little as 5mg of bupivacaine<sup>9</sup>. The addition of 10mcg fentanyl to 5mg bupivacaine in this study reduced the failure rate from 24% to zero in 50 patients. For inguinal hernia repair, 7.5mg of bupivacaine combined with 25mcg fentanyl has been shown to be effective<sup>10</sup>.

The effect of adding a small dose of fentanyl to the local anaesthetic solution is profound. It improves the quality of analgesia and reduces the incidence of block failure. The synergistic action of this combination allows us to use doses of local anaesthetic that would normally be considered subtherapeutic.

It has previously been demonstrated that 25mcg intrathecal fentanyl does not impair respiratory function or drive even in unpremedicated elderly patients with significant respiratory disease<sup>11</sup>.

## **Equipment**

A dedicated SAB trolley is useful for storage of equipment and drugs.

Some patients appreciate a personal cassette or CD player with headphones for use during the operation and this may help to avoid the need for sedation.

## **Intra-operative problems**

### **Block quality**

On rare occasions, low-dose SAB may fail completely and the patient will have no demonstrable block. In this situation, it is necessary to either repeat the block or convert to a GA. More commonly, especially when the bupivacaine dose is minimal, a block may be present but inadequate. It may then be necessary to supplement the technique. It is very reassuring for anaesthetists to know that the addition of small doses of intravenous opioids, ketamine, or midazolam can transform an inadequate low-dose SAB into a perfectly acceptable one without the need for conversion to general anaesthesia. Local anaesthetic infiltration at the site of operation, or in the form of a nerve block (e.g. ilioinguinal block) can be very helpful. In our series of 279 patients receiving 5mg bupivacaine plus 10mcg fentanyl for a variety of day case procedures, we reported an absolute failure rate of 0.7%, these requiring conversion to GA. Meanwhile, 7.9% of patients reported either mild pain or discomfort, and some of these required supplementation<sup>2</sup>.

Block quality is also relevant to the surgeon. Low dose techniques block sensory nerves in preference to motor ones. This effect, sometimes called 'selective spinal anaesthesia' tends to preserve muscle tone and power in the legs. Fortunately, absence of muscular relaxation does not seem to be an obstacle to successful surgery. Like their anaesthetist colleagues, surgeons need to adjust their expectations of the effects of spinal anaesthesia in the context of day surgery.

**Hypotension**

Low-dose SAB is generally associated with very little hypotension. For practical purposes, significant hypotension can be defined as a fall in blood pressure necessitating intervention (e.g. extra intravenous fluids or vasoconstrictors). Using this definition, we reported a 2.5% incidence of significant hypotension when using bupivacaine 5mg with fentanyl 10mcg<sup>2</sup>. We therefore suggest that this combination can be used safely in day surgery patients with significant cardiovascular disease.

**Pruritus**

We reported an incidence of pruritus of 9% when intrathecal fentanyl was used. This problem was limited to the immediate perioperative period.

## 5. Recovery and Discharge

We have used the acronym ‘S.P.I.’ as an aide memoir for nursing staff assessing fitness for discharge. In addition to the usual criteria for all day surgery patients, the following are applied:

S: straight leg raise against gravity. The patient must be able to straight leg raise before being assisted to mobilise.

P: pass urine. We currently require all SAB patients to void prior to discharge, but see discussion below.

I: information sheet. This must be given to all SAB patients before discharge. See appendix.

### Delayed discharge

The 2 factors that might contribute to delayed discharge from the DSU are:

- Leg weakness – inability to walk
- Urinary retention – inability to void

Clearly it is important to ensure that a patient has adequate return of power to the legs before mobilising. We have found that the ability to straight leg raise against gravity is a simple and adequate prerequisite to mobilisation. Other centres use more formal methods of assessment. However the return of power is assessed, it is important that nurses are on hand to assist the patient to weight bear and mobilise.

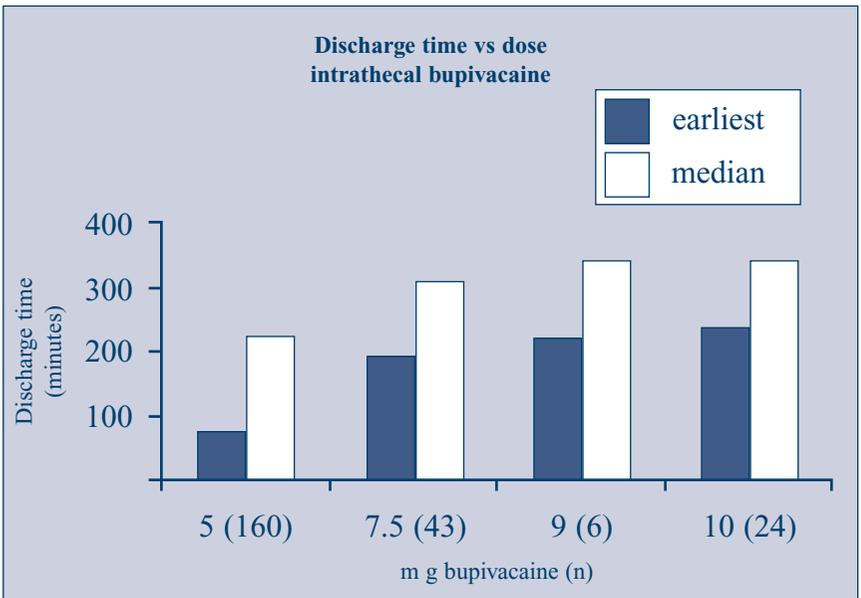
Readiness for discharge and the eventual time of discharge are rarely the same. The type of surgery and the patient’s personal circumstances will inevitably affect the actual discharge time. Moreover, anaesthetists are likely to select low-dose SAB for patients who are not fully fit and who are therefore unlikely to be rapid mobilisers. Discharge times reported in controlled trials may therefore not be achievable in day-to-day practice. Some reported discharge times after SAB for knee arthroscopy are shown below.

	Anaesthetic success rate (%)	discharge time (mins)
<b>Bupivacaine</b>		
7.5mg, 0.25% hyperbaric	100	202 +/-14 <sup>s</sup>
10mg, 0.33% hyperbaric	100	260 +/- 15 <sup>s</sup>
<b>Lignocaine</b>		
50mg, 1% hyperbaric	100	180 +/-31 <sup>12</sup>

We have perhaps reported a more realistic picture of discharge times by comparing low-dose SAB and GA with respect to discharge times for patients undergoing knee arthroscopy <sup>2</sup>.

	Discharge time (mins)	
	median	range
<b>Spinal anaesthesia</b>		
Bupivacaine 5mg + 10mcg fentanyl	270	80-405
<b>General anaesthesia</b>	170	120-270

The chart below, from the same study <sup>2</sup>, shows the actual discharge times of a series of 400 patients receiving SAB for a variety of day surgical procedures.



From this data, bupivacaine dose appears to be an important determinant of 'earliest time to discharge'. Limitation of bupivacaine dose with addition of fentanyl would therefore appear to be a logical way of minimising discharge delays.

## **Urinary Retention**

Urinary retention is a concern for day surgery patients after SAB. Most DSUs require these patients to void before discharge. The following appear to be 'low risk' factors:

- Bupivacaine dose < 7mg
- Under 70 years of age
- No history of voiding difficulty
- Not having hernia surgery, rectal or urological surgery

In our series of 400 patients receiving SAB<sup>2</sup>, the 4 cases of urinary retention occurred only after high-risk procedures (2 inguinal hernia repairs and 2 procedures for female incontinence).

In our practice, patients who develop urinary retention but are otherwise fit for discharge are catheterised and asked to return to the DSU for a trial without catheter on the following day.

If patients are to be discharged prior to voiding, it is essential that they are aware of the possibility of urinary retention and instructed to return should they fail to void within 8 hours of discharge.

Mulroy et al<sup>13</sup> demonstrated that it is not essential for these patients to void provided that ultrasound is used to exclude bladder overdistension (defined in this study as volume >400ml). This approach may obviate the requirement to void urine before discharge in low risk patients.

## 6. Follow-up

Some DSUs conduct routine telephone follow-up for all of their patients and others do not. The authors strongly recommend that any DSU introducing spinal anaesthesia to their practice should contact all SAB patients at 48 – 72 hours. The primary reasons for this are to pick up cases of post dural-puncture headache (PDPH) and to assess patient satisfaction. Staff who conduct follow-up interviews need to know in particular how to recognise PDPH.

### **Post dural-puncture headache (PDPH)**

PDPH characteristically presents as an occipito-frontal headache, which is exacerbated by adopting an upright posture and relieved by lying supine. Young patients and women are particularly susceptible. It is worth noting that PDPH is both less likely and less severe after dural puncture with a pencil-point rather than a cutting needle. Despond et al<sup>14</sup> found an incidence of 20.4% among women and 5.5% among men under 45 years having SAB for day case surgery using a Whitacre 27G needle. However, most cases were mild and only 1 patient (0.5%) required an epidural blood patch (EBP). In our series of 400<sup>2</sup>, we reported 4 patients, all female, who required EBP. These studies suggest that the incidence of PDPH requiring EBP in ambulant patients is of the order of 0.5 – 1% when small pencil-point needles are used. PDPH can be debilitating and rarely may lead to significant complications and so there should be a system for referring affected patients to the anaesthetic department. The patient must then be followed up until the symptoms have been treated or have resolved spontaneously. Readmission for assessment of the headache and EBP may be necessary.

### **Transient neurologic syndrome (TNS)**

TNS, also sometimes called transient radicular irritation, is a syndrome characterised by transient but mild to severe pain in the lower back, buttocks or legs. Typically the pain starts within 24 hours of the SAB, lasts for less than 2 days and is amenable to oral analgesia. The main risk factor for the development of TNS is the use of lignocaine in doses > 40mg when incidences of 10 – 40% have been reported. Concentration and baricity appear to be less important factors than the dose. In contrast, bupivacaine is associated with a 0-1% incidence of TNS<sup>7</sup>.

### **Patient satisfaction**

Day case SAB is associated with a reduced incidence of many of the post-operative symptoms so disliked by our patients. These include PONV, poor pain control, sore throat and grogginess. Many of our patients have specifically requested regional anaesthesia and follow-up data reveals high patient satisfaction scores<sup>2</sup>. Where patients have significant co-morbidities that make GA undesirable, the use of low-dose SAB may be the deciding factor that allows the patient access to the DSU and all its inherent advantages. For those who are still in doubt, post-discharge telephone calls will provide reassurance that patients really do appreciate spinal anaesthesia.

## 7. Low-dose spinal anaesthesia for knee arthroscopy and other procedures

Arthroscopy of the knee is a commonly performed day case procedure and very suitable for low-dose spinal anaesthesia. DSUs introducing low-dose SAB for the first time might find this procedure to be a good starting point. There are many recent publications describing spinal recipes for knee arthroscopy. Two of these are particularly relevant.

Ben-David<sup>8</sup> et al described the effect of saline dilution of heavy bupivacaine for SAB. He compared anaesthetic “success rates” when the dose of bupivacaine was increased from 5mg to 7.5mg. He found the success rate rose from 11/15 to 15/15. Ben-David later reported an increased intensity of sensory block when fentanyl 10mcg was added to hyperbaric bupivacaine 5mg<sup>9</sup>. This mixture was associated with a 100% success rate in a small series. This paper referred to the “Low-Dose Spinal” (LDS) and provided the original impetus for introducing SAB to the DSU at Kings Lynn.

A typical case might be described thus:

During the preoperative visit, we assess the patient’s suitability for SAB, explain the technique and obtain consent. In particular, we warn the patient that they may be aware of “something happening to their knee” but that they should not feel pain. They may also be aware of the tourniquet as a dull pressure. We ask them not to move their leg during the procedure, as many will retain motor power throughout. In the anaesthetic room, we secure intravenous access, establish full monitoring and then proceed to perform the SAB under aseptic conditions. The block is performed with the patient in the sitting position. We use a Sprotte 24 G needle (Pajunck) with the side-hole oriented to the side of the operation. The injectate should contain bupivacaine 5mg (which may be plain or hyperbaric) and fentanyl 10 mcg. The total volume is made up to 3 ml either by the addition of normal saline or by aspiration of CSF. The spinal needle hub can act as a “dead-space”. Moreover, small leaks between the syringe and the hub can reduce the dose delivered to the patient. Anaesthetists should be aware of this and ensure that patients receive the intended dose in full. Injection should be fairly brisk (1ml/sec). The patient may then lie flat. We confirm that a block is developing using an ice pack and then proceed to the operating room. The block is usually adequate within 10 minutes. By the time the tourniquet is applied and the knee draped the block is invariably ready. Block development rarely delays surgery. We usually administer a non-steroidal anti-inflammatory drug (NSAID) for post-operative analgesia. Patients often wish to see their knees on the television screen and discuss treatment options with the surgeon.

At the end of surgery, the patient bypasses stage 1 recovery and returns directly to stage 2 where a cup of tea and sandwich are waiting. When full motor power has returned, the patient is assisted to return to full ambulation. We encourage our patients to “take it easy” at home as excessive domestic activity might exacerbate any tendency to PDPH. We supply regular NSAIDs for 3 days with additional paracetamol and codeine for breakthrough pain. A structured telephone follow-up takes place at 48-72 hours.

### **Low-dose spinal anaesthesia for other procedures**

Although anaesthetists are familiar with conventional dose SAB, confidence with the low-dose technique takes time to develop. Successful blockade depends on a combination of local anaesthetic dose, synergy with added fentanyl and meticulous technique. The concept may then be applied to other surgical procedures, however some modification of dose may be required. For inguinal hernia repair we have found 7.5mg bupivacaine combined with 10mcg of fentanyl and ilio-inguinal block (20mls bupivacaine 2.5mg/ml) to be satisfactory. Gupta et al <sup>10</sup> recommended adding 25mcg fentanyl to 7.5mg bupivacaine. Surgeons will notice a lesser degree of muscle relaxation when comparing this technique with conventional dose SAB. Similar doses have been used successfully for foot surgery, tension-free vaginal tape, transurethral resection of prostate and bladder tumours<sup>2</sup>.

The benefits of low-dose SAB are not confined to day surgery. The technique has ‘crossed over’ to orthopaedic in-patient anaesthesia. In Kings Lynn, patients with fractures of the femoral neck are now commonly managed with a low-dose SAB (7.5mg bupivacaine plus 10mcg fentanyl) and a femoral nerve block. These patients carry a heavy burden of comorbidity and so cardiovascular stability is particularly valuable.

## 8. Summary

- SAB is not currently used routinely in UK day surgery practise
- Low-dose SAB is safe, practical, cost-effective and popular with patients
- Low-dose SAB can increase access to day surgery with regard to both the operation and the patient.
- Nursing and medical staff need to be fully prepared before SAB is introduced to day surgery.
- Good quality written patient information is essential
- PDPH is uncommon but young people and women are at increased risk. Fine bore pencil-point needles reduce PDPH to acceptable rates for day surgery.
- Low-dose bupivacaine with fentanyl provides short duration SAB without the risk of TNS.
- Requirement to void before discharge may be unnecessary in low risk patients.
- Delays in “time to discharge” due to block regression are modest and usually insignificant in comparison with delays due to social factors.
- Post-discharge follow-up arrangements are an absolute requirement.

## Appendix I

### Information for patients

1. Example of part of patient information leaflet from the Arthur Levin Day Surgery Centre, King's Lynn.

(This information was written with the help of the Royal College of Anaesthetists 'Raising the Standard: Information for patients' Feb 2003)

#### **Information for patients having General or Regional Anaesthetic**

##### Your Anaesthetic

Please have nothing to eat or drink after the time stated in your admission letter. This is very important. If there is food or liquid in your stomach during your anaesthetic it could come up to the back of your throat and damage your lungs. Your anaesthetist is a qualified doctor with specialist training. He/she will visit you before the operation and discuss the anaesthetic options and risks with you, helping you to make choices.

##### General Anaesthetic

This gives a state of controlled unconsciousness. It is essential for some operations. You are unconscious and feel nothing. General anaesthetic is started either by injecting drugs into a vein or by asking you to breathe anaesthetic gases and oxygen through a facemask.

##### Regional Anaesthetic

This involves injections that numb a large or deep part of the body. You stay conscious but free from pain. You may be offered sedation.

The Day Surgery Centre carries out many operations under regional anaesthetic. One kind of regional anaesthetic involves an injection into the lower part of your back (similar to the technique used to relieve pain in labour). It is very suitable for operations on the legs and lower body. Other types of regional anaesthetic can be used for operations on the feet, hands and shoulders.

Your anaesthetist is especially likely to suggest a regional anaesthetic instead of a general anaesthetic for you if you suffer from heart or lung problems or if you are very overweight.

2. Take home information sheet given to patients who have had SAB at the Arthur Levin Day Surgery Centre, King's Lynn.

### **Information for patients who have had a Spinal Anaesthetic**

**You have had a 'spinal anaesthetic'. This means that a small dose of local anaesthetic was injected into the fluid around your spine to 'freeze' the nerves. The effects of the injection are numbness and weakness affecting your legs and lower body. The effects take about 3 or 4 hours to wear off.**

*When you get home you should lie down for most of the rest of the day.*

You may get up and be as active as you wish tomorrow.

After you go home you may notice some side effects of the injection:

- Spinal anaesthesia does not normally cause backache but your back may be a little sore where the injection was put in.
- Your skin may feel rather itchy for a few hours.
- You may get a headache. If you do develop a headache you may take painkillers. This will often be all that is required. Rarely, patients who have had a spinal anaesthetic develop a severe headache. *If your headache is severe, stops you from going about your usual activities or is in any other way unusual, we would like to know about it.*

You can use the Day Surgery helpline numbers.

If you get a bad headache over the weekend and need to contact us about it, you can telephone the hospital switchboard on XXXXX XXXXXX and ask to speak to the on-call Anaesthetic Registrar.

Wishing you a full and fast recovery from your operation.

Dr. B. Watson

Consultant Anaesthetist, Day Surgery Centre

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The background of the entire page is a repeating geometric pattern. It consists of stylized, three-dimensional buildings with arched windows and doors, arranged in a grid. Between these buildings are stylized birds in flight, their wings spread, creating a sense of movement and rhythm. The pattern is rendered in a dark blue color against a light blue background.

**A British Association of Day Surgery Handbook**