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Calculation Skills: Sciatica (lumbar radiculopathy)

Sciatica results from irritation or compression of the nerve root in the lumbosacral spine, with symptoms including pain, numbness and tingling which can extend down the back of the leg as far as the toes (NICE, 2015). The provision of adequate pain relief is a key aspect of the management of sciatica.

Damian, a 46 year old engineer, has been diagnosed with sciatica following a recent MRI scan which, showed herniation of an intervertebral disc causing nerve root compression.

Question 1.

A step-wise approach to the prescribing of analgesia is recommended in the treatment of sciatica, with paracetamol or a non-steroidal anti-inflammatory drug (NSAID) such as ibuprofen suggested as first line treatments (NICE, 2015). Damian was prescribed the maximum dose of paracetamol 1g, to be taken 4-6 hourly, to a maximum of 4g in 24 hours. He was given an appointment for review three days later.

- (i) What is the maximum number of paracetamol 500mg tablets that Damian could take in the three days treatment?
- (ii) On day 1, Damian took his first dose at 6am, his second at 11am, his third at 5pm and his final dose at 9pm. What was the average time interval between doses?
- (iii) What time could Damian take his first tablet on day 2?

Question 2.

At his review appointment, Damian reported minimal effect from the paracetamol and was prescribed ibuprofen 400mg 4 times daily, which was to be taken in combination with his current paracetamol regime. He was prescribed enough paracetamol 500mg tablets and ibuprofen 400mg tablets to last the six days until his next appointment.

- (i) How many tablets will Damian be taking daily?
- (ii) What proportion (as a fraction) of the total tablets prescribed will be ibuprofen?

Question 3.

Damian reported limited effects from the combination therapy and it was decided that, in accordance with NICE (2015) guidance, he would be prescribed a weak opioid as the next step of his treatment. He was prescribed codeine phosphate, which has a maximum daily dose of 240mg. Damian took 30mg 4 hourly initially but had to increase the dose to 60mg each time on day 3 and onwards.

How many codeine phosphate 30mg tablets did Damian use for the first 7 days?

Question 4.

Despite previous measures, Damian's pain remains uncontrolled and he is prescribed a drug for neuropathic pain. Local policy suggests either gabapentin or amitriptyline hydrochloride as the drug of choice. Table 1 provides an example regime for gabapentin, in line with the Joint Formulary Committee (2016).

Table 1	
Day	Dose of Gabapentin
1 & 2	300mg 3 times a day
3, 4 & 5	400mg 3 times a day
6, 7 & 8	500mg 3 times a day
9, 10 & 11	600mg 3 times a day
12, 13 & 14	700mg 3 times daily

Capsules are available in strengths of 100mg, 300mg & 400mg. If all strengths were available, what would be the minimum number of capsules that could be taken for the full 14 days treatment?

Question 5.

Damian was prescribed amitriptyline and has had the dose titrated as indicated in table 2.

Table 2	
Week	Daily dose of Amitriptyline
1	10mg
2	20mg
3	30mg
4	50mg
5-6	75mg

- (i) By what percentage did the dose increase from week 1 to week 6?
- (ii) What is the total dose of amitriptyline taken over the 6 week period?
- (iii) Treatment is to be discontinued gradually over a four week period. If the dose is reduced by one third in week 7, a further $\frac{2}{5}$ th in week 8 and a further $\frac{3}{4}$ th in week 9, what daily dose will Damian be taking in week 9?

Answers

Question 1

- (i) Daily dose = 8 tablets. Three days = $8 \times 3 = 24$
- (ii) Interval dose 1-2 = 5hrs, dose 2-3 = 6hrs, dose 3-4 = 4hrs
 $5 + 6 + 4 = 15\text{hrs}$ $15\text{hrs} \div 3 = 5\text{hrs}$
- (iii) First dose taken at 6am and maximum dose taken by 9pm. 24hr period ends at 6am.
First dose on day 2 can be taken at 6am or after.

Question 2

- (i) $8 \text{ (paracetamol)} + 4 \text{ (ibuprofen)} = 12 \text{ tablets daily}$
- (ii) $\text{Total paracetamol tablets} = 8 \text{ (tablets daily)} \times 6 \text{ (days)} = 48$
 $\text{Total ibuprofen tablets} = 4 \text{ (tablets daily)} \times 6 \text{ (days)} = 24$
 $\text{Total} = 48 + 24 = 72$
 $24/72 = 1/3$

Question 3

Days 1 & 2 = 6 tablets daily $\times 2 = 12$ tablets

Days 3-7 = 8 tablets daily (maximum daily dose) $\times 5 = 40$ tablets

Total taken = $12 + 40 = 52$ tablets

Question 4

Days 1 & 2 = 300mg capsule $\times 3$ per day / total 6 capsules

Days 3, 4 & 5 = 400mg capsule $\times 3$ per day / total 9 capsules

Days 6, 7 & 8 = 400mg capsule $\times 3$ plus 100mg capsule $\times 3$ per day / total 18 capsules

Days 9, 10 & 11 = 300mg capsule $\times 2 \times 3$ per day / total 18 capsules

Days 12, 13 & 14 = 300mg capsule $\times 3$ plus 400mg capsule $\times 3$ per day / total 18 capsules

Total for 14 day period = $6 + 9 + 18 + 18 + 18 = 69$

Question 5.

- (i) Week 1 = 10mg (100%)
Week 6 = 75mg = 65mg greater than day 1
 $65\text{mg} = 10 \times 6.5 = 100\% \times 6.5 = 650\%$ increase
- (ii) $\text{Total dose taken} = (7 \times 10) + (7 \times 20) + (7 \times 30) + (7 \times 50) + (14 \times 75) = 70 + 140 + 210 + 350 + 1050 = 1820\text{mg} / 1.82\text{g}$
- (iii) Week 7: Reduction of 75mg by a 3rd = 50mg
Week 8: Reduction of 50mg by 2/5th = 30mg
Week 9: Reduction of 30mg by a 3rd = 20mg
Daily dose in week 9 = 20mg

References

Joint Formulary Committee (2016) *BNF 71*, London: BMJ Group & Pharmaceutical Press

NICE (2015) *Clinical Knowledge Summaries: Sciatica (lumbar radiculopathy)*, available at:
<https://cks.nice.org.uk/sciatica-lumbar-radiculopathy>