Calculation Skills: Hypothyroidism and Pregnancy

Hypothyroidism is defined by Thyroid UK (2015) as occurring 'when the thyroid produces less thyroid hormone than it should which causes the metabolism to run too slow'. The signs and symptoms of hypothyroidism are commonly tiredness, depression and weight gain but may also include sensitivity to cold, muscle aches or cramps, dry skin, brittle hair and nails, irregular or heavy periods and loss of libido (NHS Choices, 2015). In most cases, underactivity of the thyroid is caused by damage to the thyroid gland from the immune system or as a result of treatment for thyroid cancer or hyperthyroidism (NHS Choices, 2015). According to Thyroid UK (2015), hypothyroidism occurs ten times more often in women than men and can effect approximately 20-50% of the population.

Question 1

Jenny is 36 years old and lives in Exeter, where there is a population of 129,800.

(i) Based upon the mean* estimated incidence of hypothyroidism, what would the incidence of hypothyroidism be in Exeter?

(ii) How many of those with hypothyroidism in Exeter will be men?**

*Mean = the sum of the available amounts divided by the number of available amounts

** Tip: to find the answer, first add the ratio terms to find the whole, then convert the ratio into a fraction of the whole.

Question 2

Jenny has been diagnosed with hypothyroidism and is currently treated with levothyroxine (LT4), 125 micrograms daily. LT4 is available in tablet form in strengths of 25, 50 and 100 micrograms.

(i) What is the total number of tablets that would need to be prescribed for the months of April and May (using the fewest number of tablets)?

(ii) If no 100 microgram tablets were available, how many tablets would Jenny need for a 7 day period (again using the fewest number of tablets)?

Question 3

Jenny's condition was stabilised on a daily dose of 100 micrograms of LT4 and she has continued on this dose for the past 6 months. However, it has been confirmed that Jenny is 12 weeks pregnant and her thyroid function has been closely monitored for the past four weeks following a positive pregnancy test.

(i) Jenny's endocrinologist decides that from week 13 onwards, her daily LT4 dose needs to be increased by 25%. What will Jenny's new daily dose be?

(ii) From week 18 onwards, it is decided that the dose needs to be increased. The new dose is a 50% increase to Jenny's non-pregnancy dose. What will this new dose be?

(iii) What is the mean dose of LT4 received by Jenny for the first 20 weeks of her pregnancy?

Question 4

From 36 weeks of pregnancy, Jenny's daily dose of LT4 was increased to 200 micrograms. Following the birth of her baby Harry, her LT4 dosage is decreased gradually to return to her pre-pregnancy dose of 100 micrograms.

(i) In week 1 her daily dose was reduced by 12.5%. What was her new daily dose?

(i) In week 3 her daily dose was reduced to 62.5% of her pre-birth dose. What was her new daily dose?

(iii) By what percentage would Jenny's 'week 3' daily dose need to be reduced to in order to reach her pre-pregnancy dose?

 Question 5

Lazarus et al (2014) identified a prevalence of overt hypothyroidism in pregnancy of 0.2-0.5%. Of the 696,271 live births in England and Wales in 2016, based on the average prevalence rate, how many of these babies' mothers will have had overt hypothyroidism in pregnancy (rounded up or down to the nearest whole number)?

Answers

Question 1

(i) Mean incidence = (20+50)÷ 2 = 35%

1% = 129800 ÷ 100 = 1,298

35% = 35 x 1,298 = 45,430

(ii) Ratio = 10:1

Sum of ratio terms equals the whole: 10+1 = 11

Ratio as a fraction is 10/11 to 1/11

Therefore 1/11th of those with hypothyroidism are men

45,430 ÷ 11 = 4,130 men

Question 2

(i) Daily dose = 1 (25 microgram) tablet + 1 (100 microgram) tablet = 2 tablets

Number of days in April and May = 61

Total tablets = 61 x 2 = 122 tablets

(ii) Daily dose = 2 (50 microgram) tablets + 1 (25 microgram) tablet = 3 tablets

3 x 7 = 21 tablets

Question 3

Jenny's condition was stabilised It has been confirmed that Jenny is 12 weeks pregnant and her thyroid function has been closely monitored for the past four weeks following a positive pregnancy test.

(i) Current dose = 100 micrograms

25% = 25 micrograms

New daily dose = 100 + 25 = 125 micrograms

(ii) Non-pregnancy dose = 100 micrograms

50% = 50 micrograms

New daily dose = 100 + 50 = 150 micrograms

(iii)

Weeks 1-12 = 84 daily doses of 100 micrograms

Weeks 13-17 = 35 daily doses of 125 micrograms

Weeks 18-20 = 21 daily doses of 150 micrograms

Sum of doses received = (84 x 100) + (35 x 125) + (21 x 150) = 8400 + 4375 + 3150 = 15925

Total doses = 140

Mean dose = 15925 ÷ 140 = 113.75 micrograms

Question 4

(i) 12.5% of 200 = 25 micrograms. New daily dose = 200 - 25 = 175 micrograms

(ii) 62.5% of 200 = 125 micrograms. New daily dose = 125 micrograms

(iii) Week 3 dose = 125 micrograms. Need to reduce dose by 25 micrograms. 25 is 20% of 125. Therefore dose needs to be reduced by 20%

Question 5

Average prevalence = 0.35%

0.35% of 696,271 = 2437 (rounded up)

References

NICE (2015) Influenza - Seasonal, *Clinical Knowledge Summaries,* Available online at: https://cks.nice.org.uk/influenza-seasonal#!topicsummary

NHS Choices (2015) Flu Prevention, *NHS Choices,* Available online at: https://www.nhs.uk/Conditions/Flu/Pages/Prevention.aspx

Lazarus, J., Brown, R., Daumerie, C. et al (2014) 2014 European thyroid association guidelines for the management of subclinical hypothyroidism in pregnancy and in children. *European Thyroid Journal.* **3**(2): 76-94