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Suspected Testicular Malignancy Under the Two-Week-Wait Pathway: A Four-Year Retrospective Audit of 281 Primary Care Referrals

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Abstract

Background: The two-week-wait (2WW) pathway aims to shorten the time to diagnosis for suspected testicular cancer. Because testicular cancer is rare and most scrotal pathology is benign, the pathway's diagnostic yield in unselected primary care referrals is uncertain, and the optimal entry test remains debated.

Methods: We conducted a retrospective review of 281 general practice referrals to the testicular 2WW pathway between January 2021 and December 2024. We used patient records and WebICE to collect data on age, tumour marker testing, imaging, treatment, and histology. Cancer yield was calculated as histology-confirmed malignancies divided by total referrals.

Results: The mean age was 55.8 years; 93 (33.1%) patients were aged under 45 and 188 (66.9%) were aged 45 or older. Tumour markers were recorded for 130 (46.3%) patients. Histology-confirmed malignancy was reported in 21 (7.5% of referrals) patients. Overall, 28 patients underwent orchidectomy: histology showed 21 malignancies, one non-malignant case associated with cryptorchidism, and six benign findings. Annual referral numbers were 82 in 2021, 72 in 2022, 47 in 2023, and 80 in 2024; the reported annual malignancy yields ranged from 6.3% to 9.8%.

Conclusion: Most referrals did not result in a histology-confirmed malignancy, and the recorded overall cancer yield was 7.5%. The findings support reviewing how ultrasound is used before referral, particularly for older patients. Any change must still support timely cancer diagnosis and safe referrals.

Categories: Urology
Keywords: primary care, testicular tumours, two-week wait pathway, two-week-wait pathway, urgent suspected cancer referrals

Introduction

Testicular cancer remains an uncommon diagnosis -- accounting for approximately 0.5% of all new cancer cases in the United States, with 5.7 new cases per 100,000 males per year in 2011-2015 registries -- but it is the malignancy most closely associated with young adult men [1], and its incidence has been rising at 0.8% per year over the last decade [2]. The median age at diagnosis is 33 years (25 years for non-seminomatous tumours and 35 years for seminomas) [2], and the disease has an exceptionally favourable prognosis when identified early, with five-year relative survival of 99.1% for localised, 95.8% for regional, and 73.8% for distant disease [3]. This combination of rarity, youth, and curability makes the diagnostic pathway a high-stakes design problem: missing or delaying a diagnosis can cause serious harm, but the pathway must also use resources wisely.

The UK two-week-wait (2WW) pathway helps symptomatic patients receive a diagnosis sooner and is part of clinical guidance [4]. Its use is not evenly distributed across tumour sites: examining 669,220 patients with 35 cancers diagnosed between 2006 and 2010, patients with testicular and breast cancer were the most likely to have been diagnosed following a fast-track referral (adjusted odds ratios: 2.73 and 2.35, respectively, using rectal cancer as the reference) [4]. Testicular cancer is therefore one of the cancers most consistently routed through the urgent pathway, which makes the yield of that pathway a question of practical importance.

Existing audits have repeatedly questioned the yield [5]. In a large teaching hospital, the testicular cancer detection rate was found to raise questions about the 2WW guidelines, and the authors proposed that providing general practice (GP) with fast-track scrotal ultrasound and revising the guideline might reduce the disproportionately high number of patients referred with suspected testicular cancer [6]. A review of 124 patients referred under the scheme to one urology department found cancer in only one of 19 patients with a testicular mass. The authors concluded that testicular cancer is uncommon among patients with scrotal lumps. They suggested that, because most testicular lumps are benign, direct access to scrotal ultrasound for

GP might be the best option [7]. A further audit in Cornwall reported that GP often struggled to examine scrotal swellings and apply the 2WW guidelines, leading to many unnecessary urgent clinic visits, and suggested that it would be much more cost-effective for all such patients to have an ultrasound scan within two weeks instead of a urology clinic appointment [5]. A consensus-based primary care recommendation similarly holds that direct-access ultrasound should be considered for men with persistent or unexplained testicular symptoms [8].

A second strand of the problem is demographic. The incidence of germ cell tumours declines markedly towards the age of 50, and tumours in patients above the age of 60 are extremely rare [9]; historically, few studies have focused on testicular cancer among men aged 50 years or older [10]. Nonetheless, recent multicentre data indicate that the age profile of testicular germ cell tumours is shifting: among 193 adults, median age at diagnosis was 37 years and 87 (45.1%) patients were aged 40 years or older at diagnosis, with the proportion aged 40 years or older rising significantly from 30.8% in 2001-2010 to 54.8% in 2011-2021 (p=0.001) [11].

We reviewed referral and diagnostic data to assess the cancer yield of testicular 2WW referrals and to evaluate, by age group, whether pre-referral ultrasound could safely reduce non-cancer referrals.

Materials And Methods

Design and setting

We conducted a retrospective audit of all GP referrals to the testicular 2WW pathway at a single NHS centre over a four-year period.

Study period and population

Referrals made between January 2021 and December 2024 were included. We received 281 GP referrals through the testicular 2WW pathway for suspected urological cancer. Referrals were eligible if they met the NICE (NG12) national criteria for suspected testicular malignancy, including non-painful enlargement or a change in shape or texture.

Data sources and variables

We used patient records and WebICE to collect age, tumour marker testing, imaging, treatment, and histology data. We recorded: age at referral; whether tumour markers (beta-human chorionic gonadotropin (β-hCG), alpha-fetoprotein (AFP), and lactate dehydrogenase (LDH)) were documented and their values; clinical examination findings; ultrasound findings; pathway outcome; and whether orchidectomy was performed and, if so, its histopathological diagnosis.

Outcome definitions

Cancer yield was calculated as histology-confirmed malignancies divided by total referrals. Malignancy was defined by histopathological confirmation in an orchidectomy specimen. Cases in which histology demonstrated a benign lesion, or a non-malignant finding such as cryptorchidism, were recorded separately and were not counted towards cancer yield.

Analysis

Descriptive statistics were used throughout. Counts and proportions are presented by calendar year and for the four-year aggregate. All percentages are rounded to one decimal place. We did not conduct formal hypothesis tests, consistent with the audit design and the purpose of describing service performance against local guideline practice.

Governance

The audit was registered with the local clinical audit department. Registration number: ID3831. Ethics approval was obtained.

Results

Referral volume and case mix

Across the four-year period, 281 GP referrals were received: 82 in 2021, 72 in 2022, 47 in 2023, and 80 in 2024. Referral numbers varied, with 2023 representing the lowest annual volume (16.7% of the four-year total) and 2021 the highest (29.2%), as shown in Table *1*.

Year	Referrals	Markers documented	Imaging reported as malignant	Radical orchidectomy	Histology-confirmed malignancy	Discharge	Off the two-week-wait pathway	Cyst excision/hydrocele repair
2021	82	42 (51%)	9 (+1 inguinal testis) = 12%	10	8	66	2	4
2022	72	35 (49%)	5 = 7%	5	5	51	11	5
2023	47	24 (51%)	4 = 8.5%	4	3	29	9	5
2024	80	29 (36%)	10 = 13%	9	5	62	3	5
Total	281	130 (46.3%)	29	28	21 (7.5%)	208	25	19

TABLE 1: Referral volume, tumour marker testing, imaging, and outcome by year

The mean age of referred patients across 2021-2024 was 55.8 years. Ninety-three (33.1%) patients were under 45 years, and 188 (66.9%) were 45 years or older.

Tumour marker testing

Tumour markers were recorded for 130 of 281 (46.3%) patients. Testing was recorded in approximately 51% of referrals in 2021 and 2023, 49% in 2022, and 36% in 2024; in the 2023 sub-cohort, this corresponded to 24 of 47 (51%) patients. Thus, fewer than half of referrals had documented testing, and the rate was lowest in 2024.

Clinical examination and imaging findings

Clinical examination findings varied by year. In 2021, 7 patients had a suspicious palpable lump or mass, while 75 had a benign or normal examination. In 2022, the figures were 11 and 61; in 2023, 11 and 36; and in 2024, 12 and 68, respectively.

Imaging appearances reported as malignant (e.g., focal intratesticular mass and increased blood flow) were recorded in 10 patients in 2021 (including one inguinal testis with malignant appearance), equivalent to 12% of referrals; 5 patients in 2022 (7%); 4 patients in 2023 (8.5%); and 10 patients in 2024 (13%).

Outcomes

Pathway outcomes for each year were as follows. In 2021 (n=82): discharge in 66, stepping down from the 2WW pathway in 2, radical orchidectomy in 10, and excision of a cyst or hydrocele repair in 4. In 2022 (n=72): discharge in 51, stepping down from the 2WW pathway in 11, radical orchidectomy in 5, and excision of a cyst or hydrocele repair in 5. In 2023 (n=47): discharge in 29, stepping down from the 2WW pathway in 9, radical orchidectomy in 4, and excision of a cyst or hydrocele repair in 5. In 2024 (n=80): discharge in 62, stepping down from the 2WW pathway in 3, radical orchidectomy in 9, excision of a cyst or hydrocele repair in 5, and one referral to Cambridge University Hospital before surgery.

Discharge after review and imaging was the most common outcome each year: 66 of 82 referrals in 2021, 51 of 72 in 2022, 29 of 47 in 2023, and 62 of 80 in 2024.

Histopathology

Twenty-eight patients underwent orchidectomy across the four-year period (Table *2*). Histology confirmed malignancy in 21 patients (7.5% of all 281 referrals), and one case was associated with cryptorchidism, while six findings were benign. In total, 28 of 281 referrals (10.0%) resulted in orchidectomy; 7 of those 28 specimens (25%) showed no malignancy.

Year	Orchidectomies	Seminoma	Mixed germ cell tumour	Sertoli cell tumour	Neuroendocrine tumour	Benign
2021	10	5	1	1	1	1 + 1 (cryptorchidism)
2022	5	4	1	0	0	0
2023	4	2	1	0	0	1
2024	9	3	2	0	0	4
Total	28	14	5	1	1	7

TABLE 2: Histology of the 28 orchidectomy specimens by year

Among the 21 histology-confirmed malignancies, classical seminoma was the most frequent diagnosis (14 cases, 66.7%), followed by mixed germ cell tumour (5 cases, 23.8%), with one Sertoli cell tumour and one neuroendocrine tumour. Sixteen of the 28 orchidectomies (57.1%) were performed in men aged 45 years or older. Among men under 45, malignancy was confirmed in 10 of 12 orchidectomy specimens (83.3%), compared with 11 of 16 (68.8%) among older men. However, when calculated across all referrals, the malignancy yield was lower in men aged 45 years or older than in those under 45 (5.9% vs 10.8%). These differences should be interpreted cautiously because of the small numbers (Table *3*). The reported annual malignancy yields ranged from 6.3% to 9.8%, and the overall mean was 7.5%.

Age group	Referrals	Orchidectomies	Non-malignant histology	Histology-confirmed malignancy	Malignancy rate (malignancy/referrals)
Under 45 years	93 (33.1%)	12 (12.9%)	2 (16.7%)	10	10.8%
45 years or older	188 (66.9%)	16 (8.5%)	5 (31.2%)	11	5.9%
Total	281	28 (10.0%)	7 (25.0%)	21	7.5%

TABLE 3: Histology-confirmed malignancy by age group, 2021-2024

Discussion

Principal findings

This four-year audit of 281 GP referrals to a testicular 2WW pathway found that cancer was confirmed in 7.5% of cases. Twenty-eight (10.0%) patients underwent orchidectomy, but a quarter of those specimens (7 of 28) had non-malignant histology, including one case associated with cryptorchidism. Two-thirds of referred patients (66.9%) were aged 45 years or older, well outside the age band in which testicular germ cell tumours typically arise [12], and the mean age of 55.8 years contrasts with the published median age at diagnosis of 33 years [2].

Comparison with previous audits

Cancer was found in only one of 19 patients referred with a testicular mass in an earlier urology 2WW review, leading its authors to conclude that among patients referred with scrotal lumps, cancer of the testis is not common, and that direct GP access to scrotal ultrasonography might be the more appropriate approach for most such patients [7]. A separate audit of the two-week rule for suspected testicular cancer found that general practitioners' performance in examining scrotal swellings and applying the guidelines was very poor, generating many unnecessary urgent clinic visits, and argued that it would be much more cost-effective for all these patients to have an ultrasound scan within two weeks rather than a urology clinic appointment [5]. A recent audit of the 2WW pathway found a 3% cancer yield. Although its sample was smaller, this result supports our findings [13]. Our figures add four years of contemporary, unselected primary care data to that position. The yield was 7.5%, and most patients were discharged after review and imaging each year. In practice, the pathway mainly helps triage referrals.

Why the yield is low in older men

The cohort's age distribution offers the most plausible explanation for the low overall yield, although this remains inferential: the audit shows that benign findings predominated among older referrals but cannot explain why malignancy developed -- or did not develop -- in any individual patient.

Benign scrotal pathology is common in older men and is easily mistaken for significant disease [5,14]. Scrotal disease was present in 44.7% (773/1,731) of men aged 40 years or over undergoing systematic urological assessment, and no cancers were identified in that sample [15]. Among 60 asymptomatic men aged 70-86 years, ultrasound detected an abnormality in 51.6% (31 cases), including epididymal cysts in 15 (25%) and hydroceles in 15 [16]. In a hospital-based cohort of 801 men aged 18 years or over, sonographic epididymal cysts were present in 357 (44.6%), with prevalence increasing significantly with age (p=0.041) [17]. Hydrocele alone has a reported adult prevalence of about 1% [18]. Against this background, germ cell tumour incidence falls sharply after age 50, and tumours in men over 60 are extremely rare [9], so benign ultrasound findings in an older referral group are the expected result rather than an anomaly.

This does not mean older men cannot have testicular cancer, and it would be wrong to design a pathway on that assumption. The proportion of germ cell tumour patients aged 40 or over rose significantly between 2001-2010 (30.8%) and 2011-2021 (54.8%) [11], and the histology in this audit includes seminoma in men aged 82, 67, and 66 years. What the cohort shows is a difference in proportion, not an absence of risk: benign scans far outnumber malignant ones in older men. For this reason, the audit's malignancy yield should be interpreted against the age profile of the referral population rather than against a single benchmark applied to all scrotal referrals, since a pathway that treats every older man with a scrotal lump as a potential germ cell tumour will generate a high volume of benign orchidectomies and urgent clinic attendances [19].

Underutilisation of tumour markers

Tumour markers were documented in only 130 of 281 patients (46.3%), falling to 36% in 2024. Closing this gap is worthwhile because AFP, β-hCG, and LDH contribute to typing, prognosis, and post-orchidectomy monitoring [20]. It is less clear that better recording would sharpen triage. Only about 60% of patients with malignant germ cell tumours test positive for AFP or hCG at diagnosis [21]; only 5%-40% of seminoma tumours are positive for β-hCG [22]; AFP is usually linked to non-seminomatous disease [22]; and LDH lacks the specificity to support diagnostic decisions [21]. The audit's own results follow this pattern: several confirmed seminomas (aged 62, 38, 42, 25, 81, and 75 years) had entirely normal markers, while isolated LDH elevations occurred in malignant and benign cases alike. Low marker recording should therefore be treated as a separate quality issue rather than the principal constraint on the pathway.

The case for pre-referral ultrasound

Three findings together make a case for examining pre-referral ultrasound further: a 7.5% cancer yield across 281 referrals, two-thirds of referrals in men aged 45 or over, and a quarter of orchidectomy specimens showing no malignancy. We are cautious about how far this can be taken. An audit like this can show that many referrals are being made despite few cancers being found, and that most patients are older. But it cannot establish whether starting with ultrasound would be safer, cheaper, or quicker or rule out the chance that imaging could delay diagnosis for the small number of older men who do have cancer. Whether an age-stratified route would improve the balance between timeliness and resource use is therefore a hypothesis for prospective evaluation, not a conclusion this audit can support.

That hypothesis is nonetheless worth testing, and it is consistent with a long line of proposals and NICE guidelines supporting GP direct-access ultrasound for suspected cancer. Earlier authors argued for fast-track scrotal ultrasound for GP [6], for ultrasound within two weeks in place of a clinic appointment [5], and for direct-access ultrasound in men with persistent or unexplained testicular symptoms [8]. Ultrasound is the first-line modality for scrotal pathology even where access is limited [23].

A trialable design would route men aged 45 or older with non-suspicious examination findings to direct-access scrotal ultrasound before, or in parallel with, an urgent urology appointment, reserving the 2WW slot for suspicious examination findings, abnormal ultrasound, or men under 45 with positive examination or ultrasound findings. Any such pathway (Figure *1*) should be introduced as an evaluated pilot with defined safety endpoints rather than as a settled change in practice.

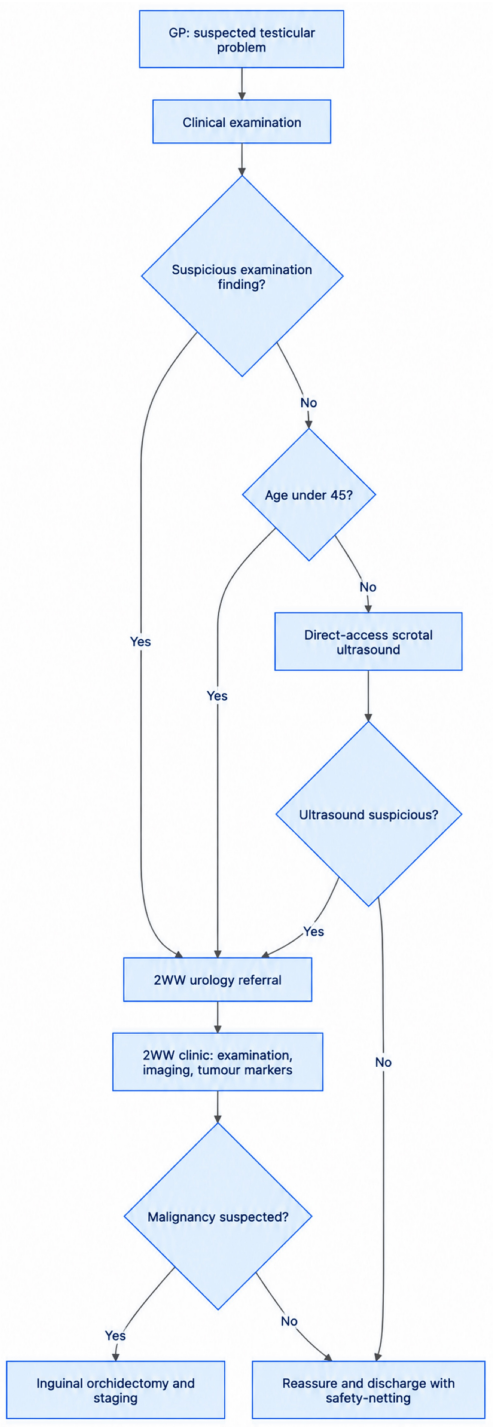

FIGURE 1: Proposed age-stratified referral design for prospective evaluation

2WW, two-week-wait; GP, general practice.

This approach has already been tried in practice: a urologist-led one-stop testicular clinic that included ultrasound saw 1,757 patients over six years, with a median age of 36 years. Ultrasound findings were suspicious in 6.3% of patients, and histology confirmed cancer in 5.6%. The median waits were nine days from referral to clinic and five days from clinic to orchidectomy [24]. Early economic modelling has explored how risk prediction might support triage and prioritisation within the NHS urgent cancer referral pathway for suspected urological cancers [25], which is the form of evaluation this question still needs.

Risks and safeguards

Any reconfiguration of the pathway carries a genuine risk of diagnostic delay, and the literature suggests that delay matters but selectively [26]. In non-metastatic disease, delays are generally linked to a higher risk of poor outcomes for non-seminomatous germ cell tumours [26]. To keep the pathway safe, there should be clear maximum time limits for getting a scan and arranging follow-up assessment.

Two design features follow from this. First, the age-stratified pathway must include clear advice: normal imaging in a man over 45 should trigger documented advice to return if symptoms persist or change, and any man with a discrete testicular mass or suspicious examination finding must continue to be referred urgently regardless of age. Second, timeliness must be audited, not assumed -- the interval from ultrasound request to scan, and from scan to orchidectomy, should be tracked as one of the metrics, since the evidence shows these intervals can be shortened by streamlining ultrasonography and running one-stop clinics [24].

Strengths and limitations

This audit looks at four consecutive years and 281 referrals, giving a more up-to-date picture of testicular 2WW referrals than most earlier single-centre studies. It also brings together clinical, imaging, outcome, and histology data, with details on each patient's age and tumour-marker results [13]. There were 10 orchidectomies in 2021, 5 in 2022, 4 in 2023, and 9 in 2024, for 28 in total. The specimens showed 14 seminomas, 5 mixed germ cell tumours, 1 Sertoli cell tumour, 1 neuroendocrine tumour, 1 cryptorchidism-associated case, and 6 benign specimens; together, these comprised 21 malignancies, one cryptorchidism case and six benign findings, matching the reported totals of 7.5% cancer yield and 28 orchidectomies.

This audit has several limitations. Because cancer yield was defined as histology-confirmed malignancy divided by total referrals, a patient with malignancy diagnosed through a route other than orchidectomy during the audit period would not have been captured. In addition, patients discharged after review and imaging without histological confirmation were assumed to be benign; no record-level follow-up was undertaken to identify later re-referral or diagnosis, so the 7.5% yield should be read as a minimum estimate rather than a true incidence. Findings from a single centre with a low volume of cases may also reflect local referral practices, clinician thresholds and population characteristics, so multicentre prospective data would be needed before the observed cancer yield and age distribution can be interpreted.

Conclusions

Most referrals to the testicular 2WW pathway did not result in histologically confirmed cancer. The audit found that many referred patients were older and that orchidectomy specimens included both malignant and benign findings. These findings support reviewing the role of ultrasound before referral, particularly for older patients. Any change to the pathway should be evaluated carefully to ensure that it does not delay cancer diagnosis or compromise patient safety.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Asyraf Maddan, Dimitar Ormanov

Acquisition, analysis, or interpretation of data: Asyraf Maddan

Drafting of the manuscript: Asyraf Maddan

Critical review of the manuscript for important intellectual content: Asyraf Maddan, Dimitar Ormanov

Supervision: Dimitar Ormanov

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **AI use statement:** The authors used Jenni AI as follows: language polishing in Introduction, Discussion, Conclusion. All grammar/language suggestion was cross checked. The authors confirm that they have reviewed and verified all AI-assisted content and take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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