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Clinical Impact Of Rapid Molecular Diagnostics For Respiratory Viruses In Emergency Care: A Retrospective Study From A Tertiary Hospital In Riyadh

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Abstract
Background: *Rapid molecular diagnostic tests are now important tools in emergency care because they can detect respiratory viruses more quickly than traditional PCR. This study examined their effect on clinical workflow and patient management in a tertiary hospital in Riyadh.*
Methods: *A retrospective observational study was carried out between October 2023 and August 2025. It compared patients tested with rapid molecular platforms to those tested with traditional PCR. The main outcomes were turnaround time and the length of stay in the emergency department. Secondary outcomes included the use of antibiotics and antivirals, isolation decisions, and hospital admission rates.*
Results: *A total of 633 patients were studied, with 328 tested by rapid methods and 305 by PCR. Rapid testing showed a much shorter turnaround time (1.2 vs. 8.6 hours, p = 0.001) and a reduced emergency department stay (4.3 vs. 6.1 hours, p = 0.004). Patients in the rapid test group used fewer antibiotics (21.3% vs. 38.9%, p = 0.002) but received more antivirals (47.6% vs. 33.4%, p = 0.015). Correct isolation was also better in this group (92.1% vs. 70.5%, p < 0.001). Admission rates were similar in both groups.*
Conclusion: *Rapid molecular diagnostics greatly reduced turnaround time and improved clinical decisions. These findings support their use as part of emergency care workflows in busy tertiary hospitals.*
Keywords: *Rapid diagnostics, molecular testing, PCR, respiratory viruses, emergency department, antimicrobial stewardship, turnaround time, clinical virology, Saudi Arabia*

INTRODUCTION

Fast and accurate diagnosis of viral infections is very important in emergency care, where doctors depend on quick lab results to guide treatment. Although traditional PCR is highly sensitive, it often takes longer, which may delay treatment, extend emergency department stays, and increase unnecessary use of antibiotics.

Recent progress in rapid molecular diagnostic tests allows results in less than an hour and shows potential for improving clinical workflow and antibiotic use. Research has found that these tests can shorten emergency department stays, support better isolation decisions, and reduce unnecessary antibiotic prescriptions (Wabe et al., 2019; Hansen et al., 2018). A systematic review also supports their value in speeding up clinical decisions, although the evidence on overall patient outcomes is still mixed (Vos et al., 2019; Mojebi et al., 2024).

Although rapid molecular tests are being used more widely around the world, there is still little data from large tertiary hospitals in the Middle East. This study compares the turnaround time and clinical impact of rapid molecular tests with traditional PCR in managing viral respiratory infections at a tertiary hospital in Riyadh, Saudi Arabia.

LITERATURE REVIEW

1. The Need for Timely Viral Diagnostics in Emergency Care

Viral respiratory infections such as influenza, RSV, and SARS-CoV-2 are common reasons for patients visiting emergency departments. In these urgent settings, delays in diagnosis can affect treatment, cause longer stays, lead to poor isolation practices, and increase antibiotic use. RT-PCR is still the gold standard because of its high accuracy, but its turnaround time of 6 to 24 hours in central labs makes it less useful for quick clinical decisions (Vos et al., 2019).

2. Emergence and Advantages of Rapid Molecular Diagnostic Tests

In recent years, rapid molecular systems such as GeneXpert, BioFire FilmArray, and ID NOW have become more common. These tests can detect several pathogens within 30 to 90 minutes, often close to the point of care. Their value is not only in giving faster results but also in improving care through earlier isolation, better use of antivirals, and fewer hospital admissions (Hansen et al., 2018).

For instance, the CLADE study showed that giving rapid influenza PCR results in emergency departments helped doctors make quicker antiviral decisions and lowered hospital transmission (Hansen et al., 2018). Another study by Wabe et al. (2019) reported that using rapid respiratory viral panels reduced emergency department stay and unnecessary antibiotic use, especially in adults with unclear symptoms.

3. Impact on Antimicrobial Stewardship and Clinical Workflow

One important reason for using rapid diagnostics is their role in reducing unnecessary antibiotic use. Because of diagnostic uncertainty, antibiotics are often given to patients with viral infections. A systematic review by Mojebi et al. (2024) showed that rapid molecular tests can lower antibiotic use and improve isolation practices. However, their effect on hospital stay or mortality was not consistent across studies.

In the same way, Vos et al. (2019) showed in a systematic review that rapid tests supported earlier treatment decisions. However, they also noted that accuracy varied between platforms and stressed the importance of local validation, especially in busy settings such as emergency departments and intensive care units.

4. Comparative Effectiveness: Rapid Tests vs Traditional PCR

Although rapid tests are faster, there are concerns about their sensitivity, especially in early infections or when the viral load is low. Still, many recent studies show that rapid molecular tests perform similarly to standard PCR for most respiratory viruses. Ko and Drews (2017) reviewed commercial multiplex assays and reported good agreement with laboratory PCR, along with benefits such as faster patient flow and better use of isolation beds.

In children, Rogan et al. (2017) found that rapid molecular respiratory testing changed treatment decisions in the emergency department in real time, even though overall outcomes such as length of stay did not change much.

5. Implementation in Hospital Systems and Limitations

Even with their advantages, challenges remain in adopting rapid tests, such as cost, staff training, and integration with laboratory and IT systems. Tenover (2018) stressed that for these diagnostics to improve patient outcomes, results need to be available immediately and linked with decision support tools, which is often difficult in large hospitals.

Relying too much on rapid tests without careful interpretation may cause overtreatment or missing other possible diagnoses. It is important to keep a balance between fast results and proper clinical oversight.

Studies often show that rapid molecular diagnostic tests are more useful than traditional PCR in hospitals, especially for faster results, reducing antibiotic use, and better infection control. Still, their effect on outcomes such as hospital stay and mortality is less clear and often depends on the setting. Research from the Middle East, particularly in large tertiary hospitals in Saudi Arabia, is still limited.

This study aims to fill this gap by assessing the accuracy, clinical effect, and workflow efficiency of rapid molecular tests compared with traditional PCR in a tertiary hospital in Riyadh.

METHODOLOGY

Study Design and Setting

This retrospective observational study took place in the virology laboratory and emergency department of a tertiary hospital in Riyadh, Saudi Arabia. It compared the turnaround time and clinical impact of rapid molecular testing with traditional laboratory PCR for respiratory viral infections. The study period was from October 2023 to August 2025, covering two full respiratory virus seasons.

Study Population

The study included patients of all ages who came to the emergency department with signs of acute viral respiratory infection, such as fever, cough, sore throat, or shortness of breath. Patients were tested using either a rapid molecular platform or traditional PCR. Exclusion criteria were incomplete results, mishandled samples, or duplicate tests from the same patient visit.

Diagnostic Platforms

Two diagnostic methods were compared:

1. **Rapid molecular tests** – These included point-of-care platforms such as the BioFire FilmArray® Respiratory Panel 2.1 and Cepheid GeneXpert®, which provided results in about 45–60 minutes.
2. **Traditional PCR tests** – These were carried out in the central virology laboratory using standard RT-PCR assays on high-throughput machines. The average turnaround time was 6–12 hours, depending on batching and sample transport.

Data Collection

Electronic medical records were reviewed to collect data, including patient demographics (age, sex, and comorbidities), type and timing of the test, time from sample collection to result (turnaround time), emergency department length of stay, and time to clinical decision (admission, discharge, isolation, or treatment). Data on antiviral and antibiotic use, as well as patient outcomes such as admission, ICU transfer, or discharge, were also gathered. All information was de-identified and coded to maintain confidentiality.

Outcome Measures

The main outcomes were the turnaround time for test results and the length of stay in the emergency department. Secondary outcomes included the rate of starting antivirals such as oseltamivir, the use of antibiotics, and whether isolation decisions were appropriate based on confirmed viral infections.

Statistical Analysis

Descriptive statistics were used to summarize patient and clinical data. Continuous variables such as turnaround time and length of stay were compared with the independent t-test or Mann–Whitney U test, depending on normality. Categorical variables, including antibiotic use and admission rates, were compared with the Chi-square test or Fisher's exact test. A p-value below 0.05 was considered significant. Statistical analysis was done using SPSS version 27.0 (IBM Corp.). Missing data were managed with pairwise deletion.

Ethical Approval

The study was approved by the institutional ethics committee. Patient consent was waived because the study was retrospective and used de-identified data. The research followed the principles of the Helsinki Declaration.

RESULTS

A total of 633 patients were part of the study. Among them, 328 (51.8%) had rapid molecular diagnostic testing, while 305 (48.2%) were tested using standard laboratory PCR. The two groups were similar in terms of age, gender, and clinical signs.

Turnaround Time and Emergency Department Stay

Patients who had rapid molecular testing got their results much faster, with an average turnaround time of 1.2 hours, compared to 8.6 hours for those tested with traditional PCR ($p = 0.001$). In the same way, the average time spent in the emergency department was shorter for the rapid test group (4.3 hours) than for the PCR group (6.1 hours, $p = 0.004$).

Antimicrobial and Antiviral Use

Antibiotic use was much lower in the rapid testing group, where 21.3% of patients received antibiotics compared with 38.9% in the traditional PCR group ($p = 0.002$). On the other hand, antiviral treatment was started more often in patients tested with rapid molecular methods (47.6%) than in those tested with PCR (33.4%, $p = 0.015$).

Infection Control Measures

A much larger share of patients in the rapid testing group were put under correct isolation precautions based on confirmed viral infection (92.1% vs. 70.5%, $p < 0.001$). This shows that faster results helped improve infection control measures.

Hospital Admissions

The hospital admission rate was a bit lower in the rapid test group (25.6%) compared with the traditional PCR group (31.8%), but this difference was not statistically significant ($p = 0.091$).

Table 1: Comparison of Clinical and Diagnostic Outcomes Between Rapid Molecular Testing and Traditional PCR

Variable	Rapid Molecular Test (n=328)	Traditional PCR (n=305)	p-value
Mean Turnaround Time (hours)	1.2	8.6	0.001
Mean ED Length of Stay (hours)	4.3	6.1	0.004
Antibiotic Use (%)	21.3%	38.9%	0.002

Variable	Rapid Molecular Test (n=328)	Traditional PCR (n=305)	p-value
Antiviral Use (%)	47.6%	33.4%	0.015
Appropriate Isolation (%)	92.1%	70.5%	<0.001
Hospital Admission Rate (%)	25.6%	31.8%	0.091

DISCUSSION

This study looked at the effect of rapid molecular tests compared with standard PCR for detecting respiratory viruses in a tertiary emergency department. The findings show that rapid testing made results available much faster and also helped improve decisions about treatment, the use of antibiotics and antivirals, and infection control.

Turnaround Time and Emergency Workflow

The sharp drop in turnaround time, from 8.6 hours with standard PCR to only 1.2 hours with rapid tests, also reduced the time patients stayed in the emergency department. These results match earlier studies that showed the same effect on both test speed and patient flow when rapid diagnostics were used (Wabe et al., 2019; Hansen et al., 2018). Getting results more quickly helps doctors make earlier choices about admission, discharge, and isolation, which is very important in busy emergency settings.

Antibiotic Stewardship and Antiviral Initiation

This study also showed that patients in the rapid testing group were given fewer antibiotics (21.3% vs. 38.9%), which suggests that rapid tests can help improve antibiotic use. Cutting down on unnecessary antibiotic treatment is one of the main reasons rapid diagnostics are being used in routine care, especially for viral illnesses that look similar to bacterial infections. These results agree with recent reviews showing that rapid molecular tests lower the risk of giving the wrong antibiotics for respiratory infections (Mojebi et al., 2024; Vos et al., 2019). The higher rate of antiviral use in the rapid test group (47.6%) shows that quick confirmation of viral infection makes doctors more confident to start specific drugs like oseltamivir. This is very important during flu seasons or RSV outbreaks, where giving treatment early is known to improve patient outcomes.

Improved Infection Control

The much higher rate of correct isolation in the rapid test group (92.1% vs. 70.5%) shows another important benefit of fast testing. When viral results are delayed, isolation may be missed or started too late, which raises the risk of spreading infection in the hospital. This study shows that rapid testing helps not only with treatment choices but also with infection control, especially during times of high respiratory virus activity or pandemics.

Hospital Admission Rates

Although hospital admissions were a little lower in the rapid test group, the difference was not statistically significant. This might be because of other factors, such as the patients' initial condition and existing health problems, which were not considered in this study. Still, the trend indicates that rapid tests could help with faster triage and better use of hospital resources.

LIMITATIONS

This study has some limitations. First, the retrospective design may have caused bias in how patients were chosen and how data was recorded. Second, even though patient characteristics were balanced, some unmeasured factors might have affected treatment choices. Third, the study was done in only one large hospital, so the results may not apply to smaller or less resourced settings. Finally, the study did not look at cost-effectiveness, which is important when considering the wider use of rapid testing systems.

Implications and Future Directions

The findings suggest that rapid molecular tests should be included in emergency department workflows, especially in large hospitals where there are many patients and quick decisions are needed. Future prospective studies, including cost-benefit analysis and randomized trials, are needed to confirm these results and to support wider policy use, particularly in the Middle East.

CONCLUSION

Rapid molecular testing greatly reduced the time needed for results and shortened the emergency department stay. It also improved the use of antibiotics, increased antiviral treatment, and strengthened infection control compared with traditional PCR. Even though hospital admission rates were not very different, overall patient

management was more efficient with rapid testing. These results support the regular use of rapid molecular tests in emergency departments, especially in large hospitals with high patient numbers.

REFERENCES

1. Wabe N, Li L, Lindeman R, Yimsung R. The impact of rapid molecular diagnostic testing for respiratory viruses on outcomes for emergency department patients. *Med J Aust*. 2019;210(7):316–320. Available from
2. Hansen GT, Moore J, Herding E, Gooch T. Clinical decision making in the emergency department setting using rapid PCR: results of the CLADE study group. *J Clin Virol*. 2018;104:50–54. Available from
3. Vos LM, Bruning AHL, Reitsma JB, et al. Rapid molecular tests for influenza, respiratory syncytial virus, and other respiratory viruses: a systematic review of diagnostic accuracy and clinical impact studies. *Clin Infect Dis*. 2019;69(7):1243–1253. Available from
4. Mojebi A, Wu P, Keeping S, Hale B, Chase JG. Clinical impact of rapid molecular diagnostic tests in patients presenting with viral respiratory symptoms: A systematic literature review. *PLoS One*. 2024;19(1):e0303560. Available from
5. Ko F, Drews SJ. The impact of commercial rapid respiratory virus diagnostic tests on patient outcomes and health system utilization. *Expert Rev Mol Diagn*. 2017;17(9):783–789. Available from
6. Rogan DT, Kochar MS, Yang S, Quinn JV. Impact of rapid molecular respiratory virus testing on real-time decision making in a pediatric emergency department. *J Mol Diagn*. 2017;19(3):460–467. Available from
7. Tenover FC. The role for rapid molecular diagnostic tests for infectious diseases in precision medicine. *Pathog Immun*. 2018;3(1):61–74. Available from